

LIVERPOOL PUBLIC MUSEUMS

Lower Horseshoe Gallery

H A N D B O O K

to

VERTEBRATE ZOOLOGY

1956

FOREWORD

The Liverpool Museums were founded in 1851, when the thirteenth Earl of Derby gave his Natural History collections to the City. In 1860 Sir William Brown provided a building in which to house the collections, and in 1867 Joseph Mayer, a Liverpool goldsmith, presented his Archaeological and Ethnographical collections. What private generosity had begun, the City was proud to maintain, and until the recent war, the Liverpool Public Museums Collections were second to none in the provinces. Then in the air raids of May 1941, the building was completely destroyed by fire, and many valuable specimens were lost. Since then the staff has struggled in difficulty and obscurity, yet remarkable success has been achieved in restoring parts of the collections, though many of the gaps made by the war can never be filled. The times are now difficult; the restoration of the museum building will be costly, and can be achieved only if the citizens appreciate its value, and manifest not only their approval of this present small contribution, but also their support for the larger project, the rebuilding of the whole museum. A good modern museum is an essential part of the apparatus of education. It supplies a visual extension to the lessons of the classroom, and the projected new museum will play its part to the full, opening its doors to school children, University students, members of scientific and learned societies, and all that larger public which, while not directly attached to any of the above is still interested in culture and education in the widest sense.



The present exhibition is very small, and cannot pretend to represent the scope and interest of our collections. It gives merely a foretaste of what may be expected when the museum is able to expand into a new and adequate building.

This Handbook to the VERTEBRATE ZOOLOGY section has been written by Mr. R. Wagstaffe, Keeper of the Department of Vertebrate Zoology, and Miss G. Rutherford, Technical Assistant in Natural History, for whose services we should like to express our appreciation.

JAMES JOHNSTONE

Chairman, Libraries, Museums and
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VERTEBRATE ZOOLOGY

Case A1

CLASSIFICATION OF THE VERTEBRATES

The Vertebrates form a sub-division of a more all-embracing group known as the Chordata. All Chordates have three fundamental structures in common, (1) a dorsal tubular nerve cord which in the higher forms becomes the brain and spinal cord, (2) a slender supporting rod - the notochord which in the higher forms becomes surrounded or replaced by the backbone, and (3) paired gill slits which persist in the adults of the lower forms up to the amphibia, but only appear in the embryo of reptiles, birds and mammals.

The Chordata are divided into the Acrania which are creatures without a distinct head or brain, and the Craniata or Vertebrata, which have a distinct brain case with a backbone or its equivalent.

The Acrania or lower Chordates, comprise the Tongue Worms which are small, soft-bodied animals living on sandy or muddy sea-beds; the Tunicates which live in the sea and secrete a tunic-like covering to the body - the best-known being the sea-squirts; and the Lancelets (such as Amphioxus which is shown here) which are fish-like and are found in shallow water off tropical and temperate sea-coasts.

The Vertebrata (Craniata) can be divided into the Agnatha - creatures without true jaws or paired limbs such as the River Lamprey exhibited here (see also Sea Lamprey, Case A2) and the Gnathostomata which possess true jaws and usually

paired limbs, and comprise the major part of the Vertebrates-fishes, amphibians, reptiles, birds and mammals.

The "study specimens" used to illustrate this simple classification differ in appearance from specimens generally used for public exhibition in that there has been no attempt to make them look life-like. They are simply preserved in such a manner as to make them compact and easy to store, and they are used for close study rather than casual observation. Fishes, reptiles and amphibians are stored in fluid, birds are skinned and stuffed with their wings folded and their bills in line with their bodies, mammals are skinned and stuffed in compact shapes always having their cleaned skulls attached since the teeth are important in the identification of mammals. Each specimen however it is preserved carries a data label bearing the date, locality, sex, etc. without which it is of little use to the classifier.

Case A2

SEA LAMPREY - Petromyzon marinus L. (Cast)

Although included here under Marine Fishes the lampreys actually belong to a group of primitive eel-like animals (Cyclostomata) which are characterized by their lack of true jaws (Agnatha = without jaws; see Introduction to Vertebrates) having instead a suctorial mouth armed with teeth. The skeleton of these creatures is cartilaginous, they have no paired fins and there is a single nasal opening on the top of the head.

The Sea Lamprey is easily distinguished from the River Lamprey by the number and position of the teeth which lie in the sucking mouth. This mouth enables the Lamprey to attach itself to other fish such as mackerel, gurnards, cod, haddock, etc., and whilst remaining attached it rasps off the flesh of

its victim. It will also attach itself to boats, a vacuum being formed between the sucker and the boat's side so that the lamprey can only be removed with considerable force.

The Sea Lamprey ascends rivers to breed attaching itself to stones on entering the estuary to prevent its being washed out to sea again; hence the name 'stone sucker' sometimes given to it. As a rule it does not travel any great distance upstream. The males and females together prepare the 'nest' which is a hollow in the river-bed, surrounded by stones. Spawning takes place between February and June after which the exhausted parents drift downstream, apparently only a few ever managing to reach the sea again. The eggs develop into larvae known as Ammocoetes and once thought to be a different species since they bear little resemblance to the adult Lampreys. These larvae spend one to two years in the river mud before migrating to the sea in the autumn.

The Sea Lamprey is much rarer than formerly owing to the present-day pollution of British rivers. Its flesh is supposed to be a great delicacy, and the death of Henry I is said to have been caused by his eating a 'surfeit of lampreys'.

FISHES (Pisces)

General characteristics

All fishes possess paired gills for breathing, fins supported by fin rays for swimming and have a skin usually covered with scales. Most have stream-lined bodies well-adapted to aquatic life. There are two sets of paired fins - a front pair of pectoral fins and a hind pair of pelvic fins - which are comparable with the paired limbs of the higher land vertebrates e.g. dog, frog; in addition there may be fins on the back (dorsal), fins on the under surface (ventral) and always a tail (caudal) fin. The modern fishes can be divided into two groups - those with cartilaginous or gristly skeletons such as sharks, skates and rays, (Cases A2, B1 & 3) and those with bony skeletons which include some of our most familiar fishes such as perch, herring, plaice, mackerel, etc. (Cases A4 & 5, B5-7, C1-5).

The cartilaginous fishes have a skin covered with placoid scales which are small hard plates each armed with a spine and not overlapping as do the scales of most bony fishes (it is this skin which, when tanned, is used commercially as shagreen); their gills open separately to the outside by paired gill-slits; the males are provided with 'claspers' for mating, and the eggs are large and contain a great deal of yolk.

In the bony fishes the skin is covered with scales which overlap so that only one small segment of the scale is exposed (these scales grow throughout life and the age of some fishes can be told from the rings on the scales); the gills open together to the outside being covered by a flap known as the operculum; there is often a gas-filled swim bladder and they lay usually a vast number of eggs which contain only a small amount of yolk.

HUMANTIN - Oxynotus paradoxus Frade (Cast)

The Humantin is a cartilaginous fish (see Fishes General characteristics p.4) belonging to a family of spiny sharks. All sharks have a body which is roughly spindle-shaped and swim by means of their strong muscular tails which are up-turned having only the upper lobe developed. They have five to seven pairs of gill openings placed on either side of the body, and the mouth is on the under surface of the head and is armed with many teeth the shape and arrangement of which are important in identification.

With its rough skin, its spines - one on each of the two dorsal fins - and the fold of skin on either side of the body giving it in cross-section a roughly triangular shape the Humantin cannot be confused with any other shark. It is found in southern waters occurring in the Mediterranean and off the Portuguese coast. There are only one or two records of this particular species for the British Isles.

HAMMERHEAD SHARK - Sphyrna zygaena(L.)

The Hammerhead takes its name from the unique shape of its head which is broad and flattened and produced on either side into a fleshy lobe which carries the eye at its free end. It is apparently not known what advantage this curious arrangement is to the fish. Although not a particularly large shark compared with other oceanic species specimens of up to $13\frac{1}{2}$ feet in length have been recorded. It is a tropical fish with a wide distribution and a few specimens have been taken off the British coast.

CHIMAERA or RABBIT-FISH - Chimaera monstrosa L. (Cast)

The Chimaeras form a link between the cartilaginous fishes (see Fishes General characteristics p.4) and a group of the bony fishes known as the gar-pikes. This particular species of Chimaera has been given a wide variety of names, being known as the Rabbit-Fish from the appearance of the

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hard plates in its upper and lower jaws, as the Rat-fish from its long, tapering tail, and as the "King of the Herrings" from its supposed appearance at the same time as large shoals of herring. The Norwegians also call it the 'gold and silver' fish from its great beauty when newly captured.

In the adult *Chimaeras* there are no scales on the body, the gill openings are covered by a flap called the operculum. The male is smaller than the female and has a peculiar appendage on the top of its head, the function of which is unknown. This species is found in the Atlantic (but not on the American side) and is not uncommon in British waters.

Case B1

SKATE - Raja batis L. (Cast)

Skates and rays are adapted to living on the sea-bed having broad flattened bodies to which are joined the expanded pectoral fins giving the fish a circular or diamond shape. The tail and the rest of the fins are small by comparison and the fishes swim by flapping the muscular side portions of the body (these muscular side portions or 'wings' are the parts of the fish which are eaten). They have a pair of spiracles, or breathing holes on the upper surface whilst the rest of the paired gill openings and the mouth are on the under surface.

All the British skates and rays lay eggs which are enclosed in a horny usually rectangular case (often known as "Mermaids' Purses"), the corners of which are drawn out into hollow tubes or horns through which the sea-water can circulate round the embryo.

The Common Skate is easily distinguished from other skates and rays by its darker under surface which is bluish-white in colour. It is taken in large numbers off the British coast both by trawling and with long-lines and one of the largest specimens caught measured roughly 9 feet in length and $6\frac{1}{2}$ feet in breadth. In the shallow waters of the Cheshire and Lancashire coasts nearly all the skates taken are small immature specimens, and it is only in the deeper waters further out that larger specimens are caught.

SHAGREEN RAY - Raja fullonica L. (Cast)

This long-snouted, rough-skinned ray is found along the coasts of western Europe northwards to the British Isles. It is a deep-water species and it is rare in British waters.

THORNBACK RAY - Raja clavata L.

This is the species which is most commonly taken off the coast of Britain and it is the one that is most commonly seen in fish-mongers' shops. It derives its name from the number of sharp curved spines resembling thorns, which are scattered over the upper surface of the body and tail. The male has four additional rows of hooked spines on either wing which are said to be used in defence. The Thornback ranges from Madeira in the Atlantic northwards to Trondhjem in Norway and is also found in the Mediterranean and Black Seas. Locally, that is, round the Lancashire and Cheshire coasts, it is very abundant occurring at all times of the year, the larger specimens being taken well off shore.

Case B2

PIKED DOGFISH - Acanthias vulgaris L. (Cast)

The Piked Dogfish can be easily distinguished from all other British dogfish by the fact that each of the two dorsal fins is armed with a spine. Its teeth are interesting because their points are so twisted round that it is the inner margins that form the cutting edges. This dogfish is one of the most destructive species to be found in British waters taking fish from both lines and nets and with its strong spines causing a great deal of damage to the latter. It is not a good food-fish although it is marketed in some towns as "Darwen salmon". In Canada it was at one time fished for the oil, fish-meal and guano that it provided.

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TOPE - Eugaleus galeus L. (Cast)

The Tope differs from the next species, the Smooth Hound, in its teeth which are small and triangular having the inner margins notched and saw-like, whereas the teeth of the Smooth Hound are flattened and arranged like a pavement. It has a wide distribution in temperate and tropical seas, and is common off the British coast where it is considered a great nuisance by fishermen whose bait it frequently takes. The young are born alive in shallow water where they remain for some time whilst the adults retire to greater depths in the winter. The Tope does not reach any great size but occasionally specimens of from 5-6 feet have been taken. It is marketed with other dogfish as "Darwen salmon".

SMOOTH HOUND - Mustelus mustelus(L.) (Cast)

The Smooth Hound resembles the Tope but has a shorter snout, no lower lobe to the tail fin, and teeth which are flattened and arranged in a pavement fashion. Like the Tope it is fairly common in British waters approaching the coast in summer for breeding purposes and retiring to deeper water in the winter. The Smooth Hound is not such a voracious feeder as the Tope, its food consisting more of molluscs, shell-fish and crustaceans than of other fishes.

Case B3

'DARKIE CHARLIE' - Scymnorhinus lichia(Bonn.) (Cast)

This dark-skinned shark is frequently landed at our west coast fishing ports, and is said to be common off the Irish Atlantic Slope at from 200-350 fathoms. It can be recognised by the two short dorsal fins which are set far back on the body and are without spines. The straight mouth has a deep groove at each angle, and the nostrils are on the tip of the snout. The teeth, always important in the identification of sharks, are small and pointed in the upper jaw and larger, fewer and triangular in the lower.

TORPEDO or ELECTRIC RAY - Torpedo nobiliana Bp. (Cast)

The electric organs in these fishes lie on either side of the body between the pectoral fins and the head; they are developed from muscles of the lower jaw. Each consists of a number of vertical, hexagonal prisms the ends of which are in contact with the skin above and below. Each prism is divided into cells by a number of delicate transverse membranes; each cell contains a jelly-like fluid and receives a branch of the nerve supplying the electric organ of that side.

The Torpedo uses its electric organs in self-defence as well as to kill or stun its prey. The strength of the shock depends on the condition of the fish. After continued activity the shocks become weaker and a period of rest is required to enable the organ to recharge. the frequency of the shocks is very high - about 150/sec. and is said to be sufficient to knock a man off his feet should he step unsuspectingly on one of these fishes.

This species lives on the sea-bed in sandy or muddy places. It is found in the Eastern Atlantic and is often taken off the coasts of Great Britain, there being one or two records for Liverpool Bay.

Case B5PLAICE - Pleuronectes platessa (L) (Cast)

Like the skates and rays the flat fish are adapted to living on the sea-bed but whereas the former are flattened from above, in the flat fish it is one side of the body that becomes the under surface and the other side the upper surface. The eye of the under side swings round to join the eye of the upper side (in the plaice it is the eye of the left side which moves round to the right side) and the whole fish becomes compressed. These changes can be observed taking place during the development of the young plaice. Up to the 30th day after hatching the young fish remains symmetrical but after this time the left eye starts to rotate round and comes to lie next to the right eye and the young fish

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acquires a new position in swimming. The plaice eventually settles down on its left side and the pigmentation of this now lower side disappears leaving only the right or upper side coloured and spotted with red.

Because of its importance as a food fish a great deal of investigation into the habits and distribution of the plaice has been carried out. The age at which spawning takes place, the sea areas in which spawning occurs, the numbers of eggs produced, the duration of the spawning period, the development of the egg, the growth rates of the mature fishes, and migration have all been subjects for study, and have produced a mass of information about this valuable food fish.

CUCKOO WRASSE - Labrus mixtus L. (Cast)

There is a great deal of colour variation between the sexes in this species. The specimen exhibited with its orange-red body and black blotches on the back, is a cast of a female. The male has the same ground colour but has five or six blue bands radiating backwards from the eye, usually two blue bands down the length of its body and blue patches on the dorsal and caudal fins.

The Cuckoo Wrasse is found on rocky coasts from the Mediterranean to the west coast of Norway and is frequently taken in British waters by sea anglers but it makes rather poor eating. It deposits its eggs in a nest made of sea weed and wedged into the rocks.

HERRING - Clupea harengus L. (Cast)

This most valuable food fish swims around in vast shoals and is caught off the east coast of the British Isles by drift nets which allow the smaller immature specimens to escape, retaining only the marketable sizes. The great drift net herring fishery commences in winter and early spring off the East coast of Scotland and gradually moves southwards, fishing off N. Shields commencing in May, off Grimsby and Whitby in June, off Lowestoft and Yarmouth in September, and Torbay and Plymouth in November. A large percentage of the fish

caught is pickled or smoked. In Scandinavia Herrings are canned like sardines (the true sardine is the young of the Pilchard - Sardina pilchardus (Walb.) a near relative of the Herring). From a study of the plankton, the small floating creatures which form the food of the Herring and other surface feeders, the Herring catch can be forecast four years in advance (the Herring takes usually four years to reach maturity).

Some Herrings spawn in spring and some in the autumn but all lay their eggs on gravelly ground, where they adhere to the stones or seaweed.

MACKEREL - Scomber scombrus (L) (Cast)

These stream-lined fishes with their widely forked fins and tiny finlets just in front of the tail are extremely fast swimmers. They travel in 'schools' near the surface of the water, approaching the coast in spring in vast numbers, and moving out to deeper waters in the winter. They are much fished off the British coasts with trawl and with line, but the fisheries on the American side of the Atlantic are even larger.

Unlike those of the Herring the eggs of the Mackerel are planktonic, i.e. they float on the surface of the water.

OLD WIFE - Spondyliosoma cantharus (Gm.)

The Old Wife with its compressed, oblong body, its single dorsal fin with a spiny and a soft portion, and its lower or anal fin with three spines is a sea-bream. Also known as the Black Sea-Bream it is found in the Mediterranean and eastern Atlantic and is taken during the summer and early autumn in the English Channel quite commonly, and more rarely off parts of the west coasts of the British Isles. Its flesh is soft and is not often eaten in this country.

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RED GURNARD - Trigla cuculus L.

In the gurnards the head is protected by strong bony plates and spines, and the first three rays of the pectoral fins are free and act as feelers. The Red Gurnard is the smallest of the British gurnards and can be distinguished by the single row of narrow plates down each side of the body. It is said to inhabit greater depths than the other species and is found off the south and west coasts of Britain, in the Irish Sea, and more rarely in the North Sea.

GREATER WEEVER - Trachinus draco L.

The Greater Weever is always treated with great respect by fishermen as it is one of the few fishes that are poisonous and can cause painful and sometimes very serious wounds. The spines of the first dorsal fin and the spine on each gill cover are grooved on either side and along these grooves and at the bases of the spines lie the poison glands. The poison has an effect similar to that produced by some snake venoms acute pain at first followed by inflammation at the site of the sting.

Unlike the Lesser Weever which lies buried in the sand with only the top of its head and the dorsal fins exposed, and which stings in self-defence when trodden on, the Greater Weever is found in deeper water and will sting on slight provocation. It is found in the North Sea, in the Mediterranean, and along the coast of Africa to the Cape, but is not so common as the Lesser Weever in British waters. The specimen exhibited was taken in Liverpool Bay and is possibly the only one that has been found in this area.

Case B6

FATHER LASHER - Cottus scorpius L. (Cast)

Also known as the Short-spined Sea Scorpion this fish has a wide distribution being found on both sides of the North Atlantic and through the Baltic to Finland. In

Greenland it is said to grow to six feet in length but the examples which are found in the rock pools and shallow water on the west coast of Britain including those which are taken in shrimp trawls in the Lancashire estuaries rarely exceed 12 inches.

The Father Lasher can be distinguished from its near relation the Long-spined Sea Scorpion by the two, not four spines which it carries on the first part (pre-operculum) of the gill-cover. In this country it spawns in early Spring and the orange-coloured egg masses are guarded by the male.

LUMPSUCKER - Cyclopterus lumpus L. (Casts)

The ventral fins of this fish form the framework of the sucker which is on the lower surface just behind the chin. With this sucker the fish attaches itself to floating objects or to rocks and stones on the sea-bed where it lies waiting for food to come within its reach.

The Lumpsucker is also known as the Sea-Hen from the parental habits of the male. The eggs are laid in shallow water where the male guards them actively from roo's, starlings and gulls when they are exposed at low water, often suffering injury himself. As the tide floods he has also to contend with the marauding habits of other fishes. During his vigil the male maintains a continual circulation of water through the egg-mass by the constant movement of his fins.

This fish is found in the northern seas and is sometimes taken in trawl and stake-nets off the Lancashire and Cheshire coasts. Both specimens exhibited are casts, the smaller and more colourful bring of a male, and the larger with the more sober colours, of a female.

CORY - Coryphaenoides rupestris Gunn. (Cast)

Belonging to the family of Grenadiers or Rat-tails distinguished by their long tapering tails, large eyes and protrusible mouths, this species is only rarely taken off the coasts of the British Isles. It is a deep-water form and little is known about its habits.

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RED SNAKE-FISH - Cepola rubescens L. (Cast)

Common in the Mediterranean this fish is only infrequently taken off the coasts of Great Britain and Ireland, and then usually after heavy gales. It appears to prefer rocky ground and is found in fairly deep water.

Case B7

STONE BASS or WRECK-FISH - Polyprion americanus (Schneider) (Cast)

The Wreck-Fish is a deep water sea-perch which derives its name from its habit of following floating timbers and pieces of wreckage. It is common in the Mediterranean and tropical Atlantic and occasionally reaches the south coasts of the British Isles. It feeds on molluscs and small fishes and its flesh is said to be excellent for eating.

BLACK FISH - Centrolophus niger (Gm.) (Cast)

This is a surface living fish related to the Mackerels. Like the Stone Bass it has the habit of following ships and floating timbers and is also reputed to act the part of a 'pilot' fish to some species of sharks. It occurs in the Mediterranean and eastern Atlantic and whilst it is said to be not uncommon at the mouth of the English Channel and off the South and West coasts of Ireland there are only a few records of the species being taken in British waters.

GAR-FISH - Belone belone L.

This silvery blue-green fish can be distinguished from all other British fishes by its long slender beak-like jaws which are armed with sharp teeth, and by its undivided dorsal and anal fins. As it approaches the shore in early summer for spawning at the same time or just before shoals of Mackerel it has been given the name of "Mackerel guide".

The Gar-Fish is often taken in Liverpool Bay but is far more common off the Welsh coast where it is said to appear every summer with remarkable regularity. Its flesh makes quite good eating but many people are prejudiced against it because of the bright green-coloured bones.

RAY'S BREEM - Brama raji (Bloch) (Cast)

With its strongly curved head completely covered with scales, its deeply-forked tail and laterally compressed body this is a most striking fish. It is a deep-sea species and has a very wide distribution ranging from Norway and the Faeroes in the north to the Cape of Good Hope in the south. It is common in the Mediterranean and makes an annual migration to British waters where it is often taken after storms.

Case A4

HALIBUT - Hippoglossus hippoglossus (L.)

This is one of the largest members of the family of Flatfishes. It has a thick, narrow body, and smooth small scales, and like the Plaice its eyes lie on the right side. A deep-water fish feeding close to the rocky sea-bed that it favours it is to be found in the north Pacific, in the North Atlantic off Iceland, and the Faeroes, and in the northern part of the North Sea. Most of the British supplies are caught by trawl and long-line off Iceland and are landed at Grimsby and Hull. As well as being used as food a valuable oil containing vitamins is extracted from the liver.

BRILL - Scophthalmus rhombus (L.)

This flatfish is similar to the Turbot in having its eyes on the left side but it is narrower in proportion to its length, and its skin is covered with small smooth scales. The dorsal fin commences far forward on the head and its first few rays are fringed and brush-like. The Brill is found at medium depths on a sandy or muddy bottom in the Mediterranean, the North and the Baltic Seas, and is common round the British Isles.

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TURBOT - Scophthalmus maximus (L.)

This is the most highly valued of the Flatfishes having an extremely good flavour. Its body is more diamond shaped than that of the Brill and the skin, though scaleless, bears many blunt bony knobs on its upper surface. It is one of the most prolific of fish the female producing 5-10 million eggs at spawning.

The Turbot is found in fairly shallow water (usually under 40 fathoms) and is often taken in seine nets at low water on the beaches off the Welsh coast. It ranges from the Mediterranean to the Norwegian coast, and forms an important part of trawlers' catches off the south and west coasts of the British Isles.

Case A5

SUN-FISH - Mola mola (L.) (Cast)

The Sun-fish is a surface-living species with a wide distribution in temperate and tropical seas. With its compressed body, short tail, and large vertical fins it is well adapted to its habit of drifting with the currents. Its jaws are feeble and covered with enamel and it feeds on small floating crustacea. The skin in this species is rough but when seen basking on the surface of the waters the colours are said to shine brilliantly. It will grow to 7 or 8 feet in diameter and specimens of this size may weigh 7 or 8 cwts. The larvae of the sun-fish are covered with spines and so vastly different from the adult that at one time the relationship between them and the adults was not appreciated. Many specimens of Sunfish are taken off the British coast every year and they are said to drift here with the Gulf Stream.

Case C1

BREAM - Abramis brama (L.)

This fish is to be found in small shoals in the sluggish waters of canals, ponds, lakes and rivers. It prefers deep muddy waters and avoids the light, feeding mainly at night when it stirs up the mud on the bottom with its pointed snout to obtain insect larvae, worms, etc. It is often fished for with a worm-baited hook and lead sinker without a float - a method known as 'ledgering'. When spawning in May and June in shallow water the fish makes a great deal of commotion leaping and splashing on the surface.

In this country the Bream is common in the east and south, but is not found in west Wales or north of Loch Lomond. It ranges throughout Central Europe eastwards to Turkestan and Siberia. In Great Britain it is not much eaten but on the Continent it is regularly fished for food.

PERCH - Perca fluviatilis L.

This well-known fish is widely distributed throughout Europe, including the British Isles, and extends eastwards to Siberia. Although mainly a freshwater species it may occur in brackish waters. It prefers water with a gentle rather than a rapid current and so is often found along the edges of rivers. In winter it retires to deeper water and becomes sluggish, but between April and May shoals of Perch rise to group themselves in the shallows for spawning. The eggs are strung together in a line and become attached to water plants. Worms, insect larvae, young live frogs, small fishes, etc. are all used successfully as bait. The Perch reaches an average weight of five pounds and its flesh makes very good eating.

DACE - Leuciscus leuciscus (L.)

The Dace is closely related to the Chub but is a more slender and much smaller fish and has a concave not a convex,

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edge to its anal or ventral fin. It ranges across Europe to the Caspian Sea. In England it is common in clear, rapid streams but it is not found in Scotland or Ireland. A lively fish, it will take gentles, worms, and paste, as well as flies. The average size is about ten inches and the weight rarely exceeds one pound. It is a more palatable fish than the Chub.

Case C2

CHUB - Squalius cephalus (L.)

This fish is easily identified by its deep broad head and large conspicuous scales. Like the Trout it is to be found in fast-running water and in the summer months it often lies on the surface to feed but will sink to the bottom at the least alarm. During the winter and in cold weather it retires to deeper water. It is a species which is found in Middle Europe and is generally distributed throughout Britain but is absent from Ireland.

The Chub spawns between May and June and the young fish swim about in large shoals near the surface. A vegetable bait such as cherries, or an animal bait - grasshoppers, young frogs etc. may be used when fishing for Chub, but when caught and cooked the flesh makes poor eating.

ROACH - Rutilus rutilus (L.)

The body of the Roach is deep and compressed but not so much so as the Rudd which it closely resembles. It also differs from the latter in having only one row of teeth in the throat (pharynx) and in having a deep red not a yellow iris. Hybrids between the two however are not uncommon.

Though absent from Ireland and rare in Cornwall, Devon and west Wales, the Roach is a very common fish elsewhere in the British Isles being abundant in the rivers, meres and ponds of Cheshire and Lancashire. It is found also in most rivers in Europe and extends eastwards as far as Turkestan and Lake Baikal in Siberia.

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The Roach is usually a bottom feeder and will take worms, gentles, and paste baits. It rarely reaches more than two pounds in weight and although it has a firm, white flesh it is not often eaten because of its earthy flavour.

Case C4

SALMON - Salmo Salar L.

The Salmon spends most of its life in the open sea but spawns in fresh water and can often be seen between September and February as it leaps the falls on its way up-river. On reaching the shallow waters of the spawning ground the female hollows out a depression known as a "redd" amongst the stones and here the eggs are laid and fertilized immediately by the male. After spawning the spent fish or "kelt" is flabby and without energy, and the previously silvery skin becomes dark red and of a thick and spongy texture.

The young Salmon passes through a number of stages in fresh water being known successively as an alevin, a parr and a smolt. At the smolt stage it leaves the river and enters the sea to live there usually for a year before returning to fresh water for spawning. The Salmon on its first return from the sea is known as a grilse.

The Salmon is commercially important on both sides of the North Atlantic. In this country it is caught by netting as well as by rod and line.

BROWN TROUT - Salmo trutta L.

The Trout is a much less graceful fish than the Salmon but is more active affording better sport for the angler. There are a great many different varieties, the colours and markings varying with age, sex, season and environment. The Trout is found in fresh water and in the sea, the Sea Trout (which like the Salmon ascends rivers to spawn) being silvery, whilst the non-migratory Trout (such as the specimen exhibited) is usually brownish and often spotted.

Fresh-water Fishes

The Trout ranges from Iceland and Northern Europe to the Mediterranean, and eastwards to the Himalayas; it is not found in North America.

PIKE - Esox lucius L.

This savage and ruthless fish lives a solitary life patrolling singly a stretch of river and seizing with its powerful jaws every fish of manageable size that comes within its reach. From February to May spawning is said to occur in the sea on certain reefs in the Baltic off the coast of Sweden. During this breeding season the fish is a rich olive colour, marked with green and yellow spots, whilst at other times of the year it is much duller. It is widely distributed in Northern Europe and Asia and is also found in North America, and it is found generally throughout the British Isles. It is fished for with live bait as well as artificial bait such as the spoon exhibited.

TENCH - Tinca tinca (L.) (Cast)

The Tench is found in sluggish or still waters where it probes on the bottom for the worms and molluscs on which it feeds. It is easily recognised by its small golden yellow scales whose colour is partially obscured by a covering of slime. Never very active, during the winter it lies motionless under stones or buried in the mud from which it rises to spawn in the summer months between April and August. It is a species which is found all over Europe, including Britain, and also in Asia Minor and Western Siberia.

AMPHIBIA

General characteristics

The Amphibia, which include frogs, toads, newts, salamanders, and some limbless, worm-like creatures known as caecilians, are adapted to living partly in fresh-water and partly on land (amphi = dual, bios = life). They are cold blooded animals with a moist, highly glandular skin and no scaly covering to the body. Most amphibians have two pairs of limbs for walking and often the hind toes are webbed for swimming. Any fins they may possess differ from those of fishes in having no supporting fin rays. They lay eggs usually in water and there is an aquatic larval stage (e.g. tadpole of frog) which breathes by gills and undergoes complex changes (metamorphosis) to become like the adult.

The Amphibians native to the British Isles are the Common Frog (Rana temporaria L.) three species of Newt (Triturus), the Common Toad (Bufo vulgaris Laurent) and the Natterjack (Bufo calamita Laurent), all of which hibernate during the winter.

REPTILIA

General characteristics

The Reptiles include lizards, snakes, turtles, tortoises, crocodiles and alligators. The name refers to the method of travel (rept = creeping) and the study of both reptiles and amphibians is known as herpetology.

Reptiles are adapted to life on land, their dry scaly skins preventing loss of moisture from the body and assisting movement on rough ground. All reptiles except snakes and some lizards have two pairs of limbs with toes ending in horny claws suited to running, crawling and climbing. Like the amphibians they are cold-blooded, their body temperature varying with that of their environment. Reptiles lay eggs with leathery or limy shells but these are sometimes retained

in the female's body until fully developed so that the young are born alive. Unlike the amphibians, reptiles do not pass through larval or tadpole stage. The young hatch out closely resembling the adult.

There are only six species of reptile in the British Isles, three of which are exhibited in Case D1. All the British Reptiles hibernate during the winter.

Case D1. BRITISH REPTILES AND AMPHIBIANS

VIPER - Vipera berus L.

The Viper, the only poisonous British snake, is shorter and thicker than the Grass Snake, and has a broader, flatter head. It averages just under 2 feet in length, females being slightly longer. There is considerable variation in colour and marking, but the snake is usually some shade of brown with a wavy or zig-zag dark line down the middle of the back.

The Viper prefers dry places - sandy heaths, moors, hill slopes, etc. and is found in all parts of Britain but never in Ireland. It is rare in Lancashire and Cheshire. It feeds on small mammals, - mice, shrews, and voles, and will also eat birds, lizards, frogs, etc. Normally it does not feed in captivity. The young (from 5 to 20) are born alive.

Accidents from viper bites are very uncommon in this country but deaths have been known to occur, particularly amongst children and people in poor health. On the Continent they are more frequent, probably because in the warmer parts of Europe the snakes are more active and more people go about barefoot.

GRASS SNAKE - Tropidonotus natrix L.

Of the three British snakes the Grass Snake is the largest, full grown females averaging 4 feet, and males 3 feet. It is also known as the Ring Snake from the presence

British Reptiles and Amphibians

behind the head of 2 patches of yellow which normally form an incomplete collar. In some large females there is no collar. The general colour above is variable being grey, olive, or brown with black spots and bars, whilst the underside is chequered black and white, or is sometimes totally black.

The Grass Snake has a wide distribution over England, Wales and south-east Scotland, but is rare in Lancashire and Cheshire. It is to be found in damp places near ponds and ditches where it feeds on frogs, toads and newts, often entering the water to obtain them. The female will lay from 12 to 48 eggs, each with a tough parchment shell and all connected in a string. She prefers a manure heap, and the heat hastens hatching which occurs in from 6 to 10 weeks.

Grass Snakes make good pets. When first captured as a means of defence they emit a foul smelling fluid from the vent, but they become gentle and tame with handling. The two specimens exhibited are young examples.

COMMON LIZARD - Lacerta vivipara Jacq.

The Common Lizard is to be found throughout Great Britain, including the Isle of Man, and is the only reptile occurring in Ireland. It can be seen among the sandhills and on the heaths and moors of Lancashire and Cheshire running nimbly through the heather and grass, or basking motionless in the sun.

This species averages about 5 inches in length, the female being of larger proportions than the male and with a tail which tapers suddenly (and not gradually as in the male) beyond the thick basal portion. The creature will shed its tail if caught by it, and a new smaller tail will grow from the stump.

The name vivipara refers to the fact that the eggs are retained in the female for development and the 6-12 young are born alive. The food of the adult consists of flies, beetles, moths, caterpillars, and spiders, - all small creatures, as the jaws of the lizard are firmly fixed and not capable of

British Reptiles and Amphibians

great distension as are those of snakes. Lizards differ also from snakes in having eyelids and a notched, not forked, tongue.

The common Lizard differs from the Sand Lizard - Lacerta agilis (see specimen in Case A1. Classification of the Vertebrates), a species found only on the sand-dunes of the Lancashire coast and in the counties of Dorset, Hampshire, and Surrey, in being smaller in size, less colourful; and in having smooth, not keeled, scales.

SLOW WORM - Anguis fragilis L.

Although snake-like in appearance the Slow-worm is a lizard. It still has the vestiges of limbs beneath its skin, possesses eye-lids, a notched not a forked tongue, and has both sides of the lower jaw firmly fixed at the front. Its scaly covering is extremely smooth and shiny, and despite its name it can move with considerable rapidity, gliding through the undergrowth of the woods and heaths which it frequents. It is generally distributed throughout the British Isles except Ireland, but is much more numerous in the south and south-west of England. It is uncommon in Lancashire and Cheshire.

Like the Common Lizard the young of the Slow-worm (6- 12 in number) are born alive. They are beautiful little creatures, silvery yellow above with a thin black line down the back, and completely black beneath.

COMMON FROG - Rana temporaria L.

This creature is so well-known both as an adult and in its tadpole stage that it needs little description. Its moist smooth skin is capable of colour changes varying with variations in intensity of light reflected from its surroundings. Its long, powerful hind legs and webbed feet make it an excellent swimmer and jumper. The male is smaller than the female and develops black pads on the fore-feet in the breeding season for gripping the female. The male also has a pair

of vocal sacs which can be inflated to amplify his croakings during courtship.

The eggs, covered with jelly, are deposited in a mass on the bottom of a pond. The adult feeds entirely on insects, slugs and worms, and in its turn forms food for many larger animals - fishes, birds, snakes, weasels etc. It is widely distributed over the British Isles, including Ireland where it was introduced early in the eighteenth century. It is abundant in Lancashire and Cheshire.

NATTERJACK - Bufo calamita Laurent

The Natterjack Toad may be at once distinguished from Common Toad (Bufo vulgaris Laurent) by the narrow yellow line that runs down the centre of its head and back. It is smaller than the Common Toad and owing to the shortness of its hind legs does not jump. Its colouration is variable and the yellow stripe is sometimes interrupted or indistinct. The underside is whitish with black spots. Although it frequents dry, sandy places it lays its string of eggs in water. It is well known on the Lancashire coast and on the sand dunes and slacks where in the spring the rhythmic croaking of many hundreds may be heard half a mile away. The Natterjack has a local distribution; it is rarer in Scotland than in England, and it is also found in the South of Ireland. It feeds on insects and worms, being more active in the evening.

Case D2. FOREIGN SNAKES

General Characteristics

Snakes form the dominant group of reptiles of the present day, there being about 2000 different species. They are world-wide but are found in greatest numbers in the tropics. There are none in New Zealand or Ireland.

Snakes have no limbs or limb-girdles (in Pythons and

Foreign Snakes

Boas there are vestiges of the hind-limbs and hip-girdle) and move by a backward pressure against the ground. The body is hitched forward part by part and the free edges of the scales on the underside, catch on any irregularities of the surface and prevent the snake slipping backwards. All the vertebrae bear ribs and these are connected to each other and to the skin by muscles making possible the sinuous movement so characteristic of snakes.

The eyes have a transparent covering continuous with the thin outer skin layer which covers the whole of the body. This outer layer is shed frequently and completely. Sloughing, as this shedding of the skin is termed, starts at the lips and extends gradually down the body, the old skin being turned inside out as the snake crawls out of it. There is no outer ear in snakes and it is likely that they pick up sound vibrations through the ground. The forked slender tongue does not sting as many people suppose but aids in the senses of smell and touch, being incessantly protruded when the mouth is closed through a small notch in the lower jaw.

Snakes are carnivorous or insectivorous. They swallow their food whole and can engulf prey much larger in diameter than themselves. This is made possible by the elastic attachment of the two halves of the lower jaw and by the bones supporting the lower jaw being moveable against the skull. The bones of the roof of the mouth are also capable of movement. The slender backward-pointing tooth in one half of the jaw clamp down on the prey as those on the other half move forward to sink in at a position further on. Alternately moving up first one side of the jaw and then the other, the snake draws itself over its prey, producing at the same time large quantities of saliva which aid the process of swallowing. The absence of a breastbone, the fact of the outer ends of the ribs being free, the soft, elastic skin between the scales, and the easily stretched walls of the gullet and stomach all allow free passage of the bulky mass of the food.

Foreign Snakes

The venom of poisonous snakes serves in the capture of prey and is also used defensively against man and other animals. It is secreted by a pair of glands in the head, connected by ducts to the poison fangs in the upper jaw. As the poison fangs are lost reserve teeth are brought into use. The venom passes down a channel on the side of the tooth to the tip so that on biting the poison is conveyed to the deepest part of the wound. In vipers and rattlesnakes (Viperidae) the poison fangs in the upper jaw usually lie flat in the mouth pointing backwards. The action of erecting these teeth and biting automatically squeezes out the contents of the poison gland. The venom of these snakes contains a 'haemolytic' agent which breaks up the blood corpuscles and attacks the lining of the blood vessels. The bitten place swells, there is local haemorrhage and the wound often becomes gangrenous. If the patient survives his complete recovery usually takes some time. The venom of cobras and related snakes (Elapidae) contains a predominance of a 'Neurotoxic' agent which attacks the nerve centres, the symptoms resulting from a bite being general prostration, paralysis, and difficulty in breathing, and death may result from asphyxiation. If the patient survives recovery is usually rapid.

Anti-venins (obtained from the blood serum of horses which have been gradually immunised to snake venom by repeated injections of minute doses of venom) are used in the treatment of snake bites, but it is well to identify the snake first as each kind of venom has distinctive qualities and requires the corresponding distinctive anti-venin, no single anti-venin serving against all snakes.

The Snakes (Ophidia) are divided into several families according to the characters of the skull.

Foreign Snakes

Case D1 continued

CORAL SNAKE - Elaps (Micrurus) fulvius (L.)

The coral snakes belong to the same family as the cobras andraits and are the only members of this family represented in America. They are small, slender, glossy snakes brilliantly coloured with rings of red, yellow and black. They are slow to attack and only if stepped on or touched will turn and bite, retaining hold on the victim. Certain harmless members of other families resemble the coral snakes in pattern and colouration, and are often mistaken for them. The species shown burrows in the ground and is often seen in the fields during the spring ploughing. It ranges from South Carolina and the Mississippi to Florida and the Gulf States, and southwards to Mexico and Central America.

COBRA - Naia tripudians (Merr.)

There are only two cobras in the entire Asiatic-Malayan region, one of which - the King Cobra (N hannah) is the largest and most dangerous poisonous reptile in the world owing to the large amount of venom that it produces and to the fact that it is very active and will attack without provocation. The Indian Cobra, the species which is shown here, is smaller and more abundant than the King Cobra and has a wider range extending as it does from the easterly shores of the Caspian Sea through Southern Asia to China, and including the Malay archipelago north to the Philippines. There are many varieties which intergrade; some have black and white spectacle markings on the hood, and others like this specimen are dark brown or black without hood markings.

The Indian Cobra is a nervous and excitable snake; it rises quickly when disturbed spreading its hood which is supported by the moveable and elongated ribs behind the head, and striking out with the front raised portion of the body in

Foreign Snakes

a forward and downward movement. It retains its hold after biting, the muscles on the head contracting to force the poison in. When chasing the small rodents and frogs on which it lives, it glides swiftly from side to side, preventing their escape.

It is often found in derelict buildings amongst the rubble and plaster, and in old stone walls.

BURROWING SNAKE - Liophis poecilogyrus (Wied.)

This species belongs to a group of American tropical snakes, non-poisonous and of moderate size. It is a secretive snake given to burrowing in damp ground and is most often seen when it crosses trails or roads after heavy rains. It is found throughout Brazil, Uruguay, Paraguay and the Argentine Republic.

Case D2

PYTHON - Python sebae (Gri.)

The African Rock Python shown here ranks as the world's fourth longest snake growing up to 20 feet in length, but usually averaging 16-17 feet. It belongs to the same family as the Boas and the Anaconda and like them has a pair of spines on either side of the vent representing the vestiges of hind limbs. It is a non-poisonous snake killing its prey by coiling round it and squeezing it until it is no longer able to breathe; contrary to popular belief the constriction is not so pronounced that the prey is crushed into an unrecognisable mass. It feeds on moderate-sized warm-blooded animals, larger jungle fowl and the young of the larger mammals.

The colour pattern of the back in this species is highly variable, but the head markings are always constant. It is found in tropical and south Africa and is one of the most

Foreign Snakes

widely distributed of African snakes.

MIDDLE EAST VIPER - Vipera lebetina L.

The Old World vipers belong to the same family as the rattlesnakes but differ from them in having no sensory pit between the nostril and the eye. This particular species; often called the Blunt-nosed Viper, is a short, heavy snake, poisonous and of a variable colour, some specimens having quite distinct patterns and others, for example those from sandy desert regions, being nearly uniform pale buff. It is of nocturnal habit, frequenting vineyards and rocky localities where there is brushwood. During the day it lies sluggishly under large stones but emerges at night to hunt small mammals. When it strikes it discharges its venom at the moment of penetration, then immediately lets go.

The species extends from Cyprus, Syria, Asia Minor, through Transcaucasia, Mesopotamia, Persia, N. Baluchistan to Afghanistan and Kashmir, and is found in N. Africa on the Atlas of Morocco and Algeria. It is restricted in Europe to the Cyclades.

SEA SNAKES - Distira viperina (Schmidt) Platurus colubrinus (Schneid.)

The sea snakes (Hydrophidae) are well-adapted to aquatic life. They are equipped with valvular nostrils on the top of the snout, and have laterally-compressed paddle-like tails which make swimming easy. The large ventral scales which assist land snakes in progression are reduced or absent in sea snakes. Some sea snakes can remain for a considerable time under water and seem to provide themselves with oxygen by swallowing and ejecting water. Others frequently come to the surface for air.

All sea snakes are venomous, the short rigid poison fangs being at the front of the upper jaw (Proteroglypha), but the

Foreign Snakes

majority are docile, and fishermen throw them out of their nets with their bare hands and are rarely bitten. They are of moderate size seldom growing to more than 3 or 4 feet in length. Some come ashore to lay eggs, and others produce live young in the sea. They abound in the Indian Ocean and the west tropical Pacific and are frequently seen off shore by passengers in ocean going liners.

BANDED SNAKE - Homalopsis buccata L.

This species belongs to the group of snakes which have the poison fangs grooved and situated at the back of the upper jaw (Opisthoglypha). The poison glands are small and the venom is not nearly so powerful as that of more highly specialized poisonous snakes. It is a semi-aquatic species found in fresh-water and in estuaries. It has nostrils protected by valves and can submerge for short periods.

It is distributed throughout southern Asia, Malaysia, and New Guinea, and is found also in Western Australia.

Case D4

GREEN SNAKE - Philodryas olfersii (Licht.)

Also known as Reinhardt's Tree Snake this species belongs to a group of snakes in which the venom fangs are situated at the back of the upper jaw (Opisthoglypha). As its name implies it is a tree-loving snake being found in the forests of South America.

RACER - Dromicus ater Gunther

The racers are a group of non-poisonous, whip-like snakes with no powers of constriction. They move swiftly over the ground to capture the comparatively small prey, - small rodents, lizards, etc., on which they feed. This species

Foreign Snakes

belongs to a group of small racers of tropical America and the West Indies. Some are speckled, some have light or dark bands extending the length of the body and some, like this specimen from Jamaica, are dark brown with no markings.

HORNED VIPER - Bitis nasicornis (Shaw)

The Horned Viper, Rhinoceros Viper or River Jack is a semi-aquatic snake found along-side streams and in swamps. With its double horns standing erect on its snout, its broad flattened head and heavy body it is an ugly-looking creature but after sloughing, its skin is velvety and beautifully patterned and coloured.

The poison fangs are enormously developed and as in all vipers and rattlesnakes they are moveably attached to the front of the upper jaw and can be folded backwards against the palate when the mouth is closed. They strike with speed, injecting the highly toxic poison by a combination strike and bite.

This species grows up to 4 feet in length and is found in West Africa from Liberia to the Gaboon.

ANACONDA - Eunectes murinus (L)

The Anaconda is the second longest snake in the world attaining a maximum proven length of 25 feet (there are unsubstantiated records of longer specimens). It belongs to the same family as the Reticulated Python which is regarded as the world's longest snake (reaching a length of 33 feet) although the Anaconda is bigger in diameter in relation to its length.

The Anaconda is a semi-aquatic species. It does not actively search for its food but lies motionless in wait for

its prey either full length along overhanging branches or submerged with only the top of its head and its eyes showing. It is non-poisonous, and kills the agoutis, capybaras, young tapirs and water-fowl on which it feeds by constriction, suffocating the life out of them with its powerful muscles.

In colouring it is olive or greenish brown with a series of large round black spots down the length of the body. It is found in tropical South America - Guianas, Brazil and N.E. Peru.

Case D5

TREE SNAKE - Gastropyxis smaragdina (Schleg.)

This slender, non-poisonous snake is a wide ranging forest species of the equatorial forest regions. It has a rather elongated head and large eyes with round pupils. The scales are not smooth but keeled and the body beneath is ridged down its length on either side. The blue-green colouring of the upper parts and the pale green beneath make it inconspicuous amongst the green leaves of the trees in which it lives. It is to be found in West Africa from Sierra Leone to the Gaboon.

AMERICAN GRASS SNAKE - Tropidonotus ordinatus (L.)

This species is similar in habits to the British Grass Snake. It is non-poisonous and is found throughout North and Central America.

GROUND SNAKE - Rhadinaea cobella (L.)

Also known as the Cobella Snake this species is non-venomous and is a forest-loving species though by no means confined to trees. Like so many other South American snakes little is known about its habits.

Foreign Snakes

RATTLESNAKE - Crotalus terrificus (Laurent)

The rattlesnake is one of the group of pit-vipers, so called because of the presence of a sensory depression between the eye and the nostril on either side of the head. The pit-vipers include some of the most poisonous of snakes - the Copperhead, the Fer-de-lance, the Moccasin and the Bush master as well as the rattlesnake.

The rattle is developed as a modification of the single scale covering the tip of the tail. This has two ring-like constrictions which separate three hollow bulbs, each one opening into its neighbour and diminishing in size to the tip of the tail. At each moult a new joint is added and the previously formed joint remains loose inside the new covering. The older joints gradually wear away so that the rattle never gets very long and indeed is sometimes broken off altogether. The whole tail vibrates rapidly shaking the loose horny 'shells' and producing a shrill buzzing sound which can be heard 20 yards away. It has been suggested that the rattle is a warning device keeping the snake from being trodden on by any hoofed animals, or mauled by carnivores.

This species is the most poisonous and boldest of the rattlesnakes. It will deliberately glide forward to attack an intruder, with its neck bent in a loop, and its head held forward ready to strike. It will coil its body up and rattle its tail furiously from the centre of the coil.

The body is heavy and ridged along the back, and the scales are keeled. The head is relatively small and the eyes are slit-like with vertical pupils. The deep yellow, golden or yellowish-green skin is interrupted by a series of darker symmetrical diamond-shaped markings with narrow paler margins. It inhabits the higher ground of an area stretching from Arizona, New Mexico and Texas to south Brazil and the Argentine.

BIRDS (Aves)

General Characteristics

In many respects birds are most highly specialized creatures. As a class almost every part of their organisation is adapted to meet the requirements of an aerial existence. Apart from the possession of feathers (which are extremely light and non-conducting) the fore-limbs are modified to form wings which are usually provided with feathers for the support of the body in flight. The sternum (breast-bone) is, in the majority of birds, greatly developed and provides, together with the shoulder-girdle, a strong surface of attachment for the principal muscles of the fore-limbs. The pelvic girdle and hind limbs have become modified to support the weight of the body when on the ground.

Modifications of this kind tend to obscure the Reptilian ancestry of birds which can only be fully appreciated after a close study of the development and structure of their skeletons. Such a study shows that the Reptilian characters are most conspicuous in the structure of the skull, the hip-girdle and hind-limbs, in the number and structure of the neck vertebrae and in other characters.

In birds the lungs are not suspended freely within the body cavity as in other Vertebrates, but are affixed to the dorsal wall of the anterior portion of the thorax. They are incapable of expansion, but air is drawn through them and is passed into thin-walled chambers known as air-sacs. In this way air is stored for respiratory purposes and assists in the regulation of temperature.

The heart of a bird, like that of a Mammal, is completely four-chambered, but owing to the enormous activity of a bird its heart-beats are quicker than those of any other warm-blooded animal, numbering about 120 when at rest and much

more during flight. Thus the temperature of a bird is greater than that of any other animal, ranging between 105-108⁸ F.

Teeth are absent in all living birds, the gullet is frequently dilated into a crop and the stomach is usually divided into a proventriculus and gizzard. The voice is produced in a syrinx which is located at or near the junction of the trachea with the bronchi. The ovary and oviduct of the right side are more or less completely atrophied, occasionally, however, they are functional. There is no urinary bladder and without exception all birds lay eggs.

Case EL. WADERS

OYSTERCATCHER - Haematopus ostralegus L.

This handsome black and white resident and passage migrant is common on the coasts of the British Isles throughout the year. It is particularly abundant during the winter months when large flocks may be seen on our local sandbanks and mud-flats. Its food consists mainly of molluscs and crustaceans and it has recently been accused of doing serious damage to the shell-fish industry. Sandhills and shingle wastes near the sea are favoured as nesting sites although it frequently breeds inland - miles away from the sea. No nest is made, but sometimes pieces of shell or stone are arranged in a nest hollow. The eggs, usually three in number are pale-brownish buff, spotted and streaked with dark brown and ashy-grey. Incubation is shared by both sexes, and lasts 21-24 days. Single brooded.

RINGED PLOVER - Charadrius hiaticula L. Adult.

From Autumn to Spring considerable numbers of this sociable little resident may be seen associating with Dunlins and other small waders, searching for molluscs, worms, small crustacea etc., on the shores of the Mersey estuary. Stretches of sand and shingle are favoured as nesting sites

Birds

where a slight hollow or scrape lined with bits of shell or small pebbles forms a nest. The eggs, usually four in number, are commonly pale stone-buff in colour freely spotted with brown-black. Incubation is by both sexes and takes 21-25 days. Two broods are usual.

GREY PLOVER - Charadrius squatarola (L.) Juvenile

This species is a shore bird when on passage through the British Isles in Autumn and Spring. Locally it occurs in some numbers on the mud-flats - north of Southport and less frequently along the coastal regions of the Wirral Peninsula. Its call note, which may be syllabled by "pee-u-wee", although similar to that of the Golden Plover - Charadrius apricarius (L.), is in a much sharper key. In nuptial plumage the Grey Plover is a handsome black, grey and white bird and looks quite different from either the juvenile (here exhibited) or adult in winter plumage. In all plumages however, this species shows in flight black axillaries a character which serves to distinguish it from all other birds of the shore.

The Grey Plover breeds on the Arctic Coasts of Europe and America.

BAR-TAILED GODWIT - Limosa lapponica (L.) Juvenile

This wader is a regular visitor to our estuaries, sand-banks and mud-flats in Autumn and is one of the more characteristic birds of the local coast. In August and September large flocks composed of juvenile and adult birds visit the mud-flats of the Ribble Estuary. Most of these birds are passage migrants - but some remain throughout the winter.

Like the Knot and Curlew-Sandpiper the Bar-tailed Godwit has a distinctive summer plumage of chestnut-red. It breeds in North Scandinavia, Finland, N. Russia; also N. Asia.

Birds

REDSHANK - Tringa totanus (L.) Adult winter

This restless, noisy, red-legged wader is generally distributed throughout the British Isles, both on the coast and inland marshes. It is a lively, interesting bird, ever on the alert and the least alarm will cause it to rise uttering its loud call note of "tyiii tyiii". In flight it exhibits a distinct wing bar and this, together with its characteristic call-note serves to establish its identity beyond all doubt. During April, many take to the moist meadow land and moorland, where a hollow in a tuft of grass serves as a nest. The eggs which are usually four in number, are of a straw colour, spotted and blotched with reddish-brown and grey. Incubation, chiefly by the female, lasts 23-25 days.

GREENSHANK - Tringa nebularia (Gunnerus)

The Greenshank appears regularly though in small numbers in both coastal and inland areas of the British Isles during Autumn and Spring. It is during the Autumn passage that its loud call note of "tchew", "tchew" is heard locally although in recent years the species has occurred during the winter months. As a breeding bird in the British Isles the Greenshank is confined to Scotland.

KNOT - Calidris canutus (L.) Adult winter

Nowhere in Great Britain is the Knot more abundant than on the mud-flats and sandbanks near Southport where it occurs particularly during the Autumn and Spring in countless thousands. During high tides when the birds are driven off their feeding areas they appear as massed flocks over the sea and at such times look like smoke from passing steamers.

Although the Knot, like the Sanderling and Curlew-Sandpiper, breeds in the far north many non-breeding birds remain on the local coasts throughout the Summer. Here they are often to be seen in full breeding plumage which is sim-

ilar in most respects to that of the Curlew-Sandpiper.

DUNLIN - Calidris alpina (L.) Adult winter

This is one of the commonest Sandpipers of the coast, particularly during Spring and Autumn. At such times large numbers of these little waders may be seen locally, restlessly searching for sand-hoppers and small molluscs on the mud-flats, or flying in compact masses over the sea. The three birds exhibited are all in winter plumage and show no trace of the black patch on the under-parts, which is characteristic of their Summer plumage.

For nesting sites, moorland and rough pastures are favoured where a neat, cup-shaped nest made of dry bents is hidden in a tussock of grass. The eggs, normally four in number, are blue-green to yellowish in ground colour, blotched or spotted with chocolate brown and ashy-grey. Incubation, which is by both sexes, lasts about 22 days.

SANDERLING - Crocethia alba (Pallas) Juvenile

The Sanderling visits all suitable portions of the coast of the British Isles including the Ribble estuary in Autumn and Spring, on its way to and from its northern breeding grounds in Spitzbergen, northern Siberia, and Greenland.

In winter plumage it can be distinguished from the Dunlin by its shorter bill, lighter upper parts, its call-note of "wit-wit" and its scurrying behaviour as it feeds along the edge of the tide.

CURLEW-SANDPIPER - Calidris testacea (Pallas) Juvenile

In juvenile and winter plumage this species is not unlike the Dunlin but is distinguished from it by its white rump which is well displayed in the juvenile bird exhibited. In summer plumage it is a handsome bird having the head, neck and mantle chestnut streaked and barred with black and grey, upper tail-coverts white tinged with buff and barred with black, and the underparts chestnut-red.

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The Curlew-Sandpiper nests on the tundras of Siberia from the Yenisei and the Taimyr Peninsula east to Cape Baranof, and on Liakhov Island and other isles of the New Siberia group.

It is one of the greatest of feathered travellers, for in Winter its visits extend to Tasmania, New Zealand and Madagascar. Locally it may be seen during the Autumn on passage along the coast and as a visitor to inland marshes and sewage farms.

PURPLE SANDPIPER - Calidris maritima (Brünnich) Adult winter

This species which is easily recognised by its dark colour, short legs and "dumpy" appearance is widely distributed along the coasts of the British Isles throughout the winter. At all times it shows a marked preference for rocky shores on which seaweed is exposed at low water. Locally it is a visitor to Hilbre Island where small numbers may usually be seen between November and May.

The breeding areas of this species nearest the British Isles are the Faroes and Iceland.

LITTLE STINT - Calidris minuta (Leisler) Juvenile

This is one of the smallest of our wading birds and occurs regularly in the British Isles in the Autumn and less frequently in Spring. Locally it is a sporadic Autumn passage-migrant in fluctuating numbers to sewage farms and inland marshes. The breeding grounds of the Little Stint are in Northern Europe and N.W. Asia.

GREY PHALAROPE - Phalaropus fulicarius (L.)

This species owes its name to the fact that when it appears in the British Isles it is usually in the grey plumage of either the adult winter or the juvenile. In nuptial dress its prevailing colour is deep chestnut. Locally

it is a sporadic late autumn and winter visitor to coastline lakes and pools chiefly after gales.

As a breeding species it is, like many other waders which visit the British Isles, circumpolar.

GREEN SANDPIPER - Tringa ocropus (L.)

This species is not an uncommon visitor to the British Isles in Autumn and Spring. Like the rarer Wood Sandpiper it is a visitor to local sewage farms and inland marshes. In flight both species display white upper tail-coverts - but the Green Sandpiper has dark brown axillaries barred diagonally white. The axillaries of the Wood-Sandpiper are white with a few pale brown bars. The Green Sandpiper breeds in N. Europe and Asia, north of a line from Denmark through Germany, Bohemia, Galicia across Russia to Transcaspia and Turkestan.

WOOD SANDPIPER - Tringa glareola (L.)

The Wood Sandpiper visits the British Isles in small numbers chiefly in Autumn. In Lancashire and Cheshire it is a rare visitor to sewage farms and inland marshes in August and September. It breeds in Europe north of a line from N. France across to the Urals, and across N. Asia and it has bred once or twice in Britain.

COMMON SANDPIPER - Tringa hypoleucos (L.)

The Summer-Snipe, as this bird is sometimes called, is a regular visitor to the British Isles, appearing in March and April and leaving again in August and September though a few birds remain until November. At such times it appears in small numbers on the estuaries of the Dee, Mersey and Ribble, as well as on local sewage farms and inland marshes. Its favourite haunts during the nesting season are mountain tarns and streams where worms, water beetles and fresh-water shrimps

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may be obtained. The nest is merely a slight hollow in the ground lined with grass and flood wrack, in which four cream-buff eggs, spotted with reddish and dark brown are laid.

TURNSTONE - Arenaria interpres (L.) Adult female. Summer plumage.

This species, conspicuous in Summer by its variegated plumage is a regular visitor to the coasts of the British Isles. It may be seen at any time of the year in small numbers at Hilbre Island. The note is a clear whistle, but a guttural twittering is often uttered by the bird when on the wing. In winter plumage both sexes have the upper parts dark blackish-brown with pale brown margins, and the sides of the head brown. The breeding areas of the Turnstone include Iceland, Greenland and Spitzbergen.

Case E2 GULLS

KITTIWAKE - Rissa tridactyla (L.) 1st Winter plumage

The Kittiwake is to be found throughout the summer months on jagged cliffs where it congregates to breed. At other times of the year it is to be seen mainly out at sea but sometimes, particularly after stormy weather, it visits the coast in considerable numbers. The specimen exhibited is in first winter plumage. (The adult lacks the black wing-coverts and black bar on the tail). The adult Kittiwake can be distinguished in the field from the Common Gull by its dark almost black legs and by the apparent absence of white "mirrors" on the flight feathers.

GLAUCOUS GULL - Larus canus L. Immature plumage

In severe winters this large circumpolar breeding gull sometimes visits the British Isles in considerable numbers but nearly always in immature plumage. In breeding dress it is not unlike a large Herring Gull with white primaries, and

in this latter respect it closely resembles its nearest relative, the smaller Iceland Gull. Both the Iceland Gull and the Glaucous Gull are of rare occurrence on the local coast, the latter particularly so.

HERRING GULL - Larus argentatus (Pontoppidan). Adult summer.

This familiar resident is more evenly distributed as a nesting species than any other British breeding gull. It is present on the local coast throughout the year. The young are mottled with brown and the adult plumage is assumed in about four years. Although a useful scavenger, it is a great robber of eggs and destroyer of young birds during the nesting season.

The Herring Gull breeds in colonies, on precipitous cliffs and grassy islands. The nest, often rather bulky, is built of grass and seaweed, and the two or three eggs are olive-green or stone coloured spotted and blotched with dark brown and grey.

GREATER BLACK-BACKED GULL - Larus marinus L. Immature.

This is the largest British-breeding gull and can be distinguished from the Lesser Black-backed Gull by its greater size and its fleshy-grey coloured legs and feet. Locally it is a common species in winter and may also be seen in summer usually in immature plumage.

It nests in colonies on islands and sometimes on moors, and often singly on coastal cliffs. The eggs usually 3 in number, are stone-buff or olive-brown, blotched and spotted dark brown and ashy.

LITTLE GULL - Larus minutus (Pallas) 1st Winter plumage.

This small gull was added to the British list by Montagu who described and figured a young bird killed near

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Chelsea prior to 1813. Since Montagu's day it has become a familiar species to many bird watchers for it occurs annually in small numbers in the British Isles. Locally it is a sporadic visitor in 1st winter plumage to the coast in autumn and winter. In summer plumage the bird is not unlike a small Black-headed Gull.

Its breeding areas include Russia from Archangel south to Moscow, Baltic Provinces, Sweden and Denmark.

BLACK HEADED GULL - Larus ridibundus (L.) Adult Summer.

Throughout the British Isles this resident is common and widely distributed. In the Spring it resorts to marshes and swamps for nesting purposes, often congregating in large colonies called "gulleries". Locally the species used to breed in some numbers in the slacks at Ainsdale and Birkdale but since these were drained twenty or more years ago it no longer does so. A small colony however has recently established itself on the salt marshes at Hundred-End near Southport. In winter plumage the chocolate coloured "hood" is lost but is sometimes resumed as early as December.

Case E4. PETRELS AND SKUAS

FULMAR PETREL - Fulmarus glacialis (L.)

Petrels are a well-defined group of birds which do not appear to be closely related to any other family. All of them have webbed feet, short tails and hooked bills but their most important characteristic is their tubular nostrils. They are essentially birds of the oceans and rarely visit land except for nesting purposes or when forced to do so by bad weather.

The largest of the common British petrels is the Fulmar which until 1878 was only known to breed in the British Isles

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on St. Kilda. Since that date, however, and for reasons not well understood, it has phenomenally increased its summer range so that at the present time nesting colonies are to be found all round the coasts of Britain.

The Fulmar when observed in flight is not unlike a gull but its remarkably sustained and gliding action on wings held noticeably straight establishes its identity beyond all doubt. One white egg is laid in a depression in the loose soil or turf of a cliff face or on the bare rock. The nestling is clothed in white or brownish-grey down.

STORM-PETREL - Hydrobates pelagicus (L.)

This, and other closely related Petrels, are known to sailors as "Mother Carey's chickens", and their habit of paddling over the waves is supposed to have originated the name 'petrel' after the Apostle Peter who attempted to walk upon the water. The Storm-Petrel outside the breeding season is a bird of the ocean but is occasionally seen locally after heavy and continuous gales. It breeds on islands off the north and west coasts of Britain and often in great numbers. The single egg, white with a few pinkish spots at the wider end, is laid in a burrow or in the crevice of a rock. The nestling, (see Case Ell) is covered in greyish down and the young bird in its first plumage resembles in all respects the adult.

MANX SHEARWATER - Procellaria puffinus Brünnich

This bird owes its name to John Ray who in Willughby's "Ornithology" called it "the Puffin of the Isle of Man", where it bred on the Calf of Man in vast numbers until the early part of the nineteenth century. Although this petrel no longer breeds on Manx territory it does so southwards on the coast of Wales. Like the Storm-Petrel it lays only one egg which is normally deposited in a burrow. In winter it is

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principally a bird of the ocean rarely visiting land unless storm-driven. Locally it may be sometimes seen skimming the waters of Liverpool Bay.

GREAT SKUA - Stercorarius skua (Brünnich)

Of the Skuas or Parasitic Gulls (so-called from their habit of robbing other sea birds such as terns and gulls of their food) the Great Skua is the largest European representative of the group. Always a rare bird on the local coast "Bonxie" as it is sometimes called, breeds in the British Isles only in the Shetlands and Orkneys. Two eggs are laid in a depression in the ground or in moss or heather and after the eggs are hatched the parents are quite fearless and unrelenting in the protection of their young.

LONG-TAILED SKUA - Stercorarius longicaudus Vieillot

An exceedingly rare visitor locally the Long-tailed or Buffon's Skua is a circumpolar breeding species. It will be noted that except for its more delicate appearance and much longer tail it is not unlike the Arctic Skua.

ARCTIC SKUA - Stercorarius parasiticus (L.)

In former days when there was a thriving colony of terns at Ainsdale, Lancashire, this species visited the local coast frequently and in some numbers during the autumn. It was not uncommon to see four, five or even more Arctic Skuas chasing and harrying the terns on the Ribble estuary. Today however, although still a regular visitor, it does not occur in such numbers.

The Arctic Skua breeds in colonies on a number of islands near the Scottish mainland, including the Orkneys and Shetland. There are two varieties of this species - one which is entirely brown, and one which is brown with yellowish un-

derparts. Where the two varieties come together they mate quite indiscriminately. The eggs, usually 2 in number, are brown, blotched and spotted with darker brown.

Case E6. WATER-SIDE BIRDS

WATER-RAIL - *Rallus aquaticus* L.

This shy and secretive species is found mainly in reed-marshes. In England it is fairly widely distributed as a breeding bird but in Scotland it is less common. With the advent of severe weather many visit the coast or seek milder conditions further south. Its nest is made of reeds and sedges and is well-concealed amongst coarse herbage. The eggs, 7-11 in number, are similar to those of the Moorhen but are smaller.

MOORHEN - *Gallinula chloropus* (L.)

Generally distributed throughout the British Isles, the Moorhen or Water-Hen is one of the commonest waterside birds. Indeed wherever ponds, ditches and streams are to be found there also is the Moorhen. The nest is a bulky affair composed of reeds and is normally built near the water on the ground but occasionally on the bough of a tree. The 7-8 eggs (sometimes more) are stone-coloured blotched with reddish-brown and the chicks are clothed in soft dark-coloured down.

COOT - *Fulica atra* L.

The Coot is distinguished from the Moorhen by the white instead of red shield on its forehead and also by its larger size and its lobed toes. Except in extremely severe weather when it takes to the coast it is found on most large lakes and reservoirs and during the winter months often in large numbers. The nest is similar to that of the Moorhen but the eggs are larger and speckled with black.

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BITTERN - Botaurus stellaris (L.)

This species owing to the gradual reclamation and cultivation of the reed-swamps and marshes which it inhabits was at one time considered to be extinct as a native British bird. Since 1911 however through rigid protection it has returned to some of its old haunts in Norfolk where the booming or bellowing of the male may once again be heard during the breeding season. The nest, which is composed of dry reeds, is built on the ground amongst reeds and other herbage, and the 4-6 eggs are of a uniform brownish colour although when fresh they sometimes have a greenish tint.

HERON - Ardea cinerea L.

The Heron is fairly common throughout the British Isles where it usually breeds in colonies known as heronries, in high trees. There are several well-established colonies in Lancashire and Cheshire. The nest is a large flat structure made of sticks and the eggs, 3-4 in number, are of a beautiful bluish-green. Incubation lasts about 26 days and a second clutch is sometimes laid whilst the first brood still occupies the nest. In winter, especially during hard weather, the Heron forsakes its inland breeding areas for the coast.

Case E8. BIRDS OF PREY

SPARROW-HAWK - Accipiter nisus (L.)

Hawks differ from Falcons in having shorter and more rounded wings, longer legs and in lacking a toothed and notched bill. Of those which occur in the British Isles the Sparrow-Hawk is by far the commonest. It lacks none of the spirit and dash of a falcon and frequents well-wooded country. Its prey consists chiefly of small birds. The nest

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which is usually built in a tree is composed of sticks and the 3 or 4 eggs are white boldly blotched with brown. The sexes as can be seen from the specimens exhibited differ considerably in size and colour.

PEREGRINE FALCON - Falco peregrinus Tunstall

Used extensively in falconry the Peregrine for its size and bulk is probably the strongest and most courageous of all birds of prey. Of late years it has bred near the docks of Liverpool but locally it is chiefly known as a passage bird along the shore in autumn. Here it harries the wild-fowl and to watch it single out and strike down a Knot or a Godwit is a spectacle few bird-watchers are likely to forget. Like the Kestrel this species does not construct a nest but utilizes the bare ground or some overhanging cliff or the nest of a Crow. The eggs, 2-4 in number, are similar to those of the Kestrel, but are larger. Abroad the Peregrine is represented by allied forms, indeed, under one form or another it may be said to occur in most parts of the world.

KESTREL - Falco tinnunculus L.

The Kestrel, also known as the Windhover owing to its habit of hovering for some time over one spot as it seeks its prey, is by far the commonest falcon in the British Isles and is abundant in Lancashire and Cheshire. It breeds in the disused nests of Crows and Magpies and also in hollow trees and old buildings, laying 4-5 eggs which are white heavily mottled with reddish-brown. Although it may occasionally take a small bird, or even a Partridge, the Kestrel is mainly beneficial to farmers as it feeds principally on voles and other small rodents.

HOBBY - Falco subbuteo L.

This falcon is a summer visitor to the British Isles and

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breeds fairly regularly in counties south of the Thames. It is a rare visitor to the north of England. On the wing it is most graceful and agile and displays much the same mastery of the air as the Peregrine. Its food however consists largely of insects such as dragonflies, beetles etc., although small birds are occasionally taken.

The Hobby does not construct its own nest but occupies that of another bird such as a Crow. The eggs are similar to those of the Merlin.

COMMON BUZZARD - Buteo buteo (L.)

Owing to the lack of game-keepers during the war years, this large and handsome hawk has considerably increased in the British Isles. Although of rare occurrence locally the bird as it soars and swoops on broad rounded wings held almost horizontally is a familiar sight in Wales and the Lake District. Small mammals, especially rabbits, voles and rats form the Buzzard's principal food, but birds and carrion are sometimes taken.

The nest is a bulky structure composed of sticks and is built in trees, on sea cliffs and occasionally on the ground. The eggs, normally 2 in number are not unlike those of the Sparrow-Hawk but are larger.

HEN-HARRIER - Circus cyaneus (L.)

Harriers are birds of prey which have long thin legs (tarsi), hooked bills and owl-like faces and of the three species which nest in the British Isles the Hen Harrier is considered to be mainly an autumn and winter visitor. It breeds in small numbers on the moorlands of the Orkney Islands and Outer Hebrides and occasionally on the moorlands of England and Wales. Small birds and mammals which are taken by surprise and picked up from the ground form its principal food.

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The nest consists of a hollow in the ground with a few bits of heather and other vegetation arranged round it. The 4-6 eggs are bluish-white sometimes with a few rusty-red markings.

MERLIN - *Falco columbarius* L.

This falcon is distinguished from other British falcons by its small size, striated under parts and by the absence of a moustachial streak. The female differs from the male mainly in having the upper parts dark brown instead of slate blue. As a breeding bird in the British Isles it is mainly confined to the moors and mountain pastures of the north of England, Wales and Ireland. Locally it is a regular passage migrant in autumn and winter. The eggs, 4-6 in number, are reddish brown in colour and are usually laid on the bare ground amongst heather.

Case ELO. GARDEN BIRDS

CHAFFINCH - *Fringilla coelebs* L. Male Adult.

Although there may be some doubt about the statement that the Chaffinch is the most abundant bird in the British Isles there can be no doubt that the male is one of the most colourful of garden birds. The female is more soberly clad in yellow-brown. Apart from its characteristic call-note of "pink pink" and its loud rattling song, the Chaffinch is known to many for the compactness and beauty of its nest. The bulk of it is composed of grasses, roots, wool and moss, decorated externally with lichen, spiders' webs, bits of bark and sometimes paper. The 4 to 5 eggs are greenish-blue with spots and streaks of purplish-brown. The Chaffinch is a typical member of the finch family in which the bill is conical and short and well adapted for cracking seeds.

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TREE-SPARROW - Passer montanus (L.) Adult.

Less attached to human habitations than the House-Sparrow - Passer domesticus (L.) this species is distinguished from its ally by its rather smaller size, the black patch on its ear covert and chocolate-coloured head. Moreover in the Tree-Sparrow the sexes are alike. It haunts secluded gardens and orchards, old hedgerow trees and pollard willows, and holes in ivy-covered trees are favourite nesting sites. The 4-6 eggs are similar to those of the House-Sparrow but are darker and more glossy.

RED-BACKED SHRIKE - Lanius collurio L. Adult male

This species is a member of a well-marked family of medium sized predatory perching birds in which the bill is hooked and provided with a distinct notch and tooth. The Red-backed Shrike, however, is the only member of the family to visit the British Isles regularly during the summer, frequenting thickets and bushy places, mainly in central and southern England and also in Wales. It feeds principally on insects and small birds, which are either dismembered immediately as they are held down with one foot, or impaled on a thorn or barbed wire to form a "larder" of surplus food. The nest is usually placed near the ground in brambles or other undergrowth and is built of moss, roots and grass. The eggs, 5 to 6 in number, are variable in ground colour, ranging from pinkish to brownish and are invariably zoned at the larger end with reddish spots. The female differs from the male principally in being not so brightly coloured, in having barred underparts and in lacking the black facial markings.

COMMON WHITETHROAT - Sylvia communis Latham

This species is a summer visitor to the British Isles, arriving from Africa in April (exceptionally in March) and departing in August and September. It is one of the common

est warblers and frequents hedgerows, thickets overgrown with brambles, etc., and its particular liking for nettle-beds has earned it the name of "Nettle-creeper".

From its nearest ally, the Lesser Whitethroat - Sylvia curruca (L.), it is mainly distinguished by its larger size and the rufous margins of its secondaries. The sexes are more or less alike but the female lacks the vinous tint on the breast. The nest is mainly composed of grasses and is placed in a straggling hedge or amongst almost any kind of low-growing vegetation. If the nest is approached after the 4 to 6 greenish, blotched purplish, eggs are laid, and particularly when it contains young, the characteristic harsh scolding of the male is almost sure to be heard.

BLACKBIRD - Turdus merula L. Adult male

The adult male Blackbird is a familiar garden bird, but the brown female and young birds are often confused with the Song Thrush - Turdus ericetorum Turton. More skulking than most thrushes the Blackbird, if disturbed in the open readily takes cover in thick undergrowth in which it may often be heard turning over leaves and other material in search of food. Its song compared with that of the Song Thrush is richer, flute-like and more sustained. The nest is usually placed a few feet from the ground and is not unlike the Song Thrush's but is lined with dry grass.

GREAT TIT - Parus major L. Adult

This regular visitor to the garden is distinguished from the Blue Tit - Parus caeruleus L. by its larger size and glossy black crown. At the bird-table both species are equally acrobatic and frequently hang upside down as they vigorously hammer away at a suspended piece of suet or coconut. In default of natural nesting sites flower pots, nesting boxes and even letter boxes are utilized. The 4-11 eggs are like those of the majority of other tits, white spotted with

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reddish-brown. In appearance the sexes are similar.

ROBIN - Erithacus rubecula (L.) Adult.

The engaging manner and trustful disposition of the Robin has made it the best known and most beloved of all British birds. Apart from a short period in late summer when it is moulting it is a conspicuous and often pugnacious inhabitant of the garden. Four to six or more white, freckled reddish eggs are laid in the side of a bank or in a hole in a tree or wall, and sometimes in an old boot or a kettle. Indeed any unexposed position on or near the ground provides the Robin with a suitable nesting site. The young birds are not like the adults, being brown with speckled breasts and it is not until their first Autumn moult that their breasts become red.

MAGPIE - Pica pica (L.) Adult.

The harsh chattering of the Magpie may sometimes be heard in well-wooded gardens and parks in or near large cities. The Magpie, however, is mainly a bird of the outskirts of woods and thick hedges in the country, where in late March or early April it constructs its large domed nest in a thorn bush or tall tree. The eggs, 4 to 6 or more in number, are greenish-blue closely spotted with brown. The sexes are alike.

BULLFINCH - Pyrrhula pyrrhula (L.) Male adult.

A low piping "deu-deu" or the flash of a white rump are often the only clues to the presence of a Bullfinch for it is a shy and wary bird. The sexes like those of the Chaffinch differ markedly in colour, although when flying both of them exhibit a white rump. The male, as can be seen from the specimen exhibited, has the whole of the underparts

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bright red, whereas the underparts of the female are pinkish grey. The Bullfinch visits the garden mainly to feed on fruit buds and it is thus no friend of the gardener. The nest is built of twigs, mosses and roots and is normally placed in a thick hedge or in a clump of evergreens. The eggs, 4 to 5 in number, are not unlike those of the Chaffinch but are less boldly spotted.

WREN - Troglodytes troglodytes (L.) Adult.

Known for its small size, loud song and perky up-turned tail the wren has almost as many traditional associations as the Robin. At home in woods, hedgerows, glens and amongst rocks it constructs its large domed nest of leaves and mosses in shrubs and bushes overgrown with brambles, in ivy-covered walls and in many other places. The eight or more eggs are white, spotted with red, and it is usual for two broods to be reared in a season. In winter old nests are sometimes resorted to for warmth and shelter. The sexes are alike.

SONG-THRUSH - Turdus cricetorum Turton. Adult.

Spotted underparts, together with buff under-wing coverts are characteristics which distinguish this species from other British thrushes. Its vigorous broken song too, although sometimes confused with that of the Blackbird is equally specific. So, also, is its mud-or dung-lined nest, its blue, black-spotted eggs and its habit of smashing the shells of snails against an "anvil" of brick, stone or wood. The sexes are alike.

Case E12. GAME BIRDS

BLACK GROUSE - Lyturus tetrix L.

This resident species is found in the north of England

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and Scotland, and to some extent occurs in the Midlands, southern and south-western counties of England. It frequents scrub and sparsely wooded places fringing moorlands where in the spring, during morning and evening the males engage in elaborate nuptial displays, dancing and posturing before assembled hens. The male, commonly known as the blackcock, is polygamous and takes no share in the duties of hatching the eggs and caring for the young. The female, or grey-hen, makes a slight nest in a hollow in the ground sheltered by grass or heather. The 6-10 eggs are yellowish-white spotted with orange-brown.

PARTRIDGE - Perdix perdix (L.)

The Partridge is generally distributed throughout England and Wales, but is local in Scotland and scarce in Ireland. It shows a preference for extensively cultivated land where large quantities of snails and slugs, injurious insects and weeds are consumed. The nest, a slight hollow in the ground lined with dry grass and roots, is usually placed under the shelter of coarse vegetation, hedgerows or bushes. The eggs, normally 10 to 15, and sometimes as many as 20, are of a pale olive-brown. Incubation is by the female only, and lasts 23-25 days. It is single brooded.

RED-LEGGED PARTRIDGE - Alectoris rufa (L.)

Often referred to as the French Partridge this species was introduced into Suffolk about 1770 and has since successfully established itself in various places, especially in the eastern counties. Its habits and behaviour are similar to those of the Common Partridge but it is more restless and nervous and habitually perches on barns, walls, fences, etc. The sexes are alike.

The nest is merely a slight hollow in the ground lined with a few dead leaves and grasses and often sheltered by a bush or rank herbage. The eggs, 10-15 in number are pale

buff, speckled and blotched with rufous brown.

PHEASANT - Phasianus colchicus L.

This handsome long-tailed resident is distributed generally throughout the British Isles. It is a semi-domesticated bird of parks, woodlands and game preserves and in most districts could not maintain itself in the absence of close protection. The nest, a mere hollow in the ground, is sparsely lined with a few leaves and grasses, in which 10-14 olive-brown eggs are laid.

CAPERCAILLIE - Tetrao urogallus L.

This resident species, the largest game bird in the British Isles, became extinct in the British Isles about 1760 and was re-introduced in 1837 into Perthshire from Sweden. Since that date it has spread to many parts of Scotland. The female is smaller than the male, has a reddish patch on the breast and is barred and mottled with black, buff and greyish-white. The nest is a hollow scraped in the ground near the trunk of a tree or under a bush and the eggs, from 6 to 12 in number, are pale reddish-yellow spotted with brown. Females of this species occasionally pair with Blackcock, producing hybrids.

RED GROUSE - Lagopus scoticus (Lath.)

Apart from artificially-introduced stock in Western Europe this well-known game bird is confined to the British Isles where upland moors and low-lying peat bogs form its principal haunts. Its food consists chiefly of vegetable matter including young shoots, flower and seed heads, especially those of heather. A hollow in the ground sheltered by heather and lined with dead grasses serves as a nest. The eggs, usually 6-11 in number are yellowish-white in ground colour freely blotched with rich dark chocolate or

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red-brown. It is an abundant bird on the moorlands of Lancashire and Cheshire.

Case E13. OWLS

TAWNY OWL - Strix aluco L.

This is the Brown Owl whose hollow moaning "Too-hoo-oo" may be heard at night in most wooded districts. During the day it remains concealed in a hollow tree and appears to dislike the sunlight more than any other British Owl. Preying chiefly on voles, rats, mice and small birds it makes no nest, breeding in hollow trees or old nests and occasionally in burrows. The eggs, 2-4 in number are smooth, white, and nearly round in shape and are sometimes laid as early as February.

LONG-EARED OWL - Asio otus (L.)

This owl, so named from the long, erectile feathers or "horns" on the top of its crown, is a woodland bird which is seldom seen by day. It is to be distinguished from the Short-eared Owl by its longer "horns" and by its barred as well as streaked underparts. Its breeding sites include old dreys of squirrels, nests of Magpies and Woodpigeons, and it occasionally nests on the ground amongst heather. The eggs, normally 4 or 5, are white.

LITTLE OWL - Athene noctua (Scopoli)

Originally introduced about 1887 notably by the late Lord Lilford near Oundle, Northants, the Little Owl has now spread to all parts of England and Wales. Its small size, plaintive cry and undulating flight prevent confusion with any other resident British Owl. It hunts at dusk and early morning or when feeding young, often in broad daylight. Its

its head and underparts become mainly white, it rarely moves far from the vicinity of the shore. It breeds in several parts of the British Isles notably in the Hebrides, Orkneys and Shetlands and more sparsely in several places elsewhere including the Isle of Man. Unlike other auks the Black Guillemot normally lays 2 eggs and occasionally 3. These are usually deposited in a crevice near the base of a cliff and are white, cream or bluish-green spotted or blotched with reddish-brown and ash-grey. Locally the Black Guillemot is an extremely rare visitor.

PUFFIN - Fratercula arctica (L.)

The Puffin breeds in colonies on the grassy slopes of many of the sea-cliffs of the British Isles and spends the winter at sea. One whitish egg is laid a few feet down a burrow which is either excavated by the bird itself or appropriated from a Rabbit or Shearwater. It is interesting to note that during the autumn the outer sheath of the Puffin's extra-ordinary bill together with the rim at the base of the upper mandible is shed, the bill in consequence becoming much smaller and of a different shape. The horny appendages above and below the eye are also shed during the autumn.

LITTLE AUK - Plautus alle (L.)

During the winter this Auk regularly occurs off the northern and eastern shores of the British Isles but unless storm-driven it is not often observed in the vicinity of the coast. It breeds in Iceland and also on Jan Meyen, Bear Island, Franz Josef Land, Novaya Zemlya and Greenland. The single pale, greenish-blue egg is deposited out of the way of Arctic Foxes in holes and tunnels under stones or on cliffs up to 200 feet above sea-level. The adult in summer differs from the specimen exhibited (which is in winter plumage) in having the chin and throat sooty black.

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RAZORBILL - Alca torda L.

One of the better known members of the Auk family the Razorbill like the Puffin spends the winter at sea, and towards the latter part of March and early April assembles on suitable sea-cliffs of the British Isles to breed. The single egg, white blotched with brown or black, is laid in a rock crevice or on an overhanging ledge and after the duties of incubation are over the adults accompanied by the young birds return to the open sea towards the end of August.

The specimen exhibited is in winter plumage. In summer plumage the head, throat and neck are sooty black.

Case E16. DIVERS AND GREBES

RED-THROATED DIVER - Colymbus stellatus Pontopp.

The Red-throated Diver is a common visitor to all our coasts in winter and is rarely observed with the red throat - the chief characteristic of its breeding plumage. In the British Isles it is only known to breed in the north of Ireland, parts of Scotland and adjacent islands. Little or no nest is made and the two large olive brown eggs spotted with dark brown, are laid on the bare ground close to the water's edge.

BLACK-THROATED DIVER - Colymbus arcticus L.

This species is fairly common during the breeding season about the large lochs of the north and west of Scotland, when its black throat and generally pied plumage are its main distinguishing features. In winter when it appears off our coasts it is more difficult to separate from the other divers which are all superficially much alike in winter plumage. Like all divers the 'black-throat' is slow and awkward on land but in the water it is an expert swimmer and

diver. The nest usually constructed of flattened herbage is built near the water's edge and the eggs, 2 in number, are olive-brown spotted with black.

GREAT NORTHERN DIVER - Colymbus immer Brünnich

This is the largest of the three divers which occur regularly in the British Isles. It is a winter visitor only, breeding in Bear Island, Iceland, Greenland, and North America. It appears in British waters in September and the majority depart in April.

RED-NECKED GREBE - Podiceps grisegena (Boddaert)

Of the five British grebes the Red-necked Grebe is the only one which does not breed in the British Isles. Although extremely rare locally (as it is elsewhere on the west coast) it is a regular autumn and winter visitor to the tidal estuaries of the east coast. In winter plumage it resembles the Great Crested Grebe, but lacks the white streak above the eye. The Red-necked Grebe breeds in Scandinavia and northern Europe where like other grebes it nests on fresh-water lakes and lagoons.

LITTLE GREBE - Podiceps ruficollis (Pallas)

Generally distributed throughout the British Isles but less plentiful in Scotland this grebe haunts ponds and rush-fringed lakes where small fish, insects, molluscs and vegetable matter form its principle food. The nest, a bulky structure composed of aquatic vegetation is normally placed in a clump of rushes and the 4-6 eggs are similar to those of the Great Crested Grebe but are considerably smaller. The specimen exhibited is in winter plumage. In summer plumage the sides of the head and neck are reddish-chestnut.

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GREAT CRESTED GREBE - Podiceps cristatus (L.)

Owing to protection this grebe has greatly increased in the British Isles. It now nests commonly on many meres in England and Wales where formerly it was rare or absent. The nest is a floating mass of wet, decaying vegetation and is usually placed in a reed-bed. The 4-5 eggs are white when fresh but soon become brown from contact with decomposing vegetation with which they are covered when the parent leaves the nest. The specimen exhibited is in winter plumage having lost the crest and neck-ruff which are characteristic of the bird in summer dress.

SLAVONIAN GREBE - Podiceps auritus (L.)

Apart from the breeding season this species is mainly marine frequenting sheltered bays and estuaries. Locally it is chiefly known as a winter visitor in small numbers. A few scattered pairs breed on several Scottish lochs and its nesting habits are similar to those of other grebes. In winter plumage, the Slavonian and Black-necked Grebes are similar but the former can be distinguished by its straighter and stouter bill. It is considerably larger than the Little Grebe and smaller than the Great Crested and Red-necked Grebes.

Case El7. GEESE

BEAN GOOSE - Anser arvensis arvensis Brehm

As a winter visitor to the British Isles the Bean Goose is not uncommon in Northumberland, Norfolk, Suffolk and in some parts of Scotland. Elsewhere it is irregular and scarce. Locally it is the rarest of the grey geese. The adult is characterised by its long weak bill - orange in the centre, black at the base and on the nail - and by its pale to orange-yellow legs and feet. In general colour it is browner and often conspicuously darker than the majority of grey geese.

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The Bean Goose breeds in N. Europe in Norway, Finland, N. Sweden and N. Russia; Kolguev, Novaya Zembya, and in Siberia east to the Taimyr Peninsula.

PINK-FOOTED GOOSE - Anser arvensis brachyrhynchus Baillon

A winter visitor to the British Isles from N.E. Greenland, Iceland and possibly Spitsbergen, the Pink-footed Goose is preeminently the goose of the Ribble estuary and Martin Mere near Southport, where, in most years, between October and January the resident population consists of three to four thousand birds. Throughout the day the geese are to be found in the stubble fields of the Mere, but fly to the shore in the evening to roost.

Compared with the Bean Goose the Pink-footed Goose is smaller, has a shorter bill, black at the base and tip (nail) the remainder being rose-pink, whilst the legs and feet are normally pink.

WHITE-FRONTED GOOSE - Anser albifrons (Scop.)

Like the Bean and Pink-footed Goose the White-fronted Goose is a winter visitor to the British Isles arriving from its northern breeding quarters in early October and departing in late April or May. Although it occurs regularly in small numbers in both Lancashire and Cheshire its main haunts include the bogs of Ireland and the Inner and Outer Hebrides. The juvenile bird shows no white at the base of the upper mandible and is normally without any black markings on its underparts.

Case E18. DUCKS

GOOSANDER - Mergus merganser L. Adult male and female.

Saw-billed ducks which are represented in this case by the Goosander and Red-breasted Merganser have the bill long and narrow and furnished with saw-like 'teeth'. There are

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four species on the British List and of these the Goosander is the largest as well as one of the commonest to visit inland waters during the winter months. Locally it occasionally visits the estuary of the Dee and also the meres of Cheshire. In summer apart from non-breeding birds, it is restricted to Scotland where, in spite of persecution in the interests of fresh-water fisheries, it breeds freely in the vicinity of lochs and rivers.

The 8-13 creamy or buffish-white eggs are laid in a hole in a trunk of a tree or sometimes in a recess beneath gnarled roots. Apart from down, little or no nesting material is used.

RED-BREASTED MERGANSER-Mergus serrator L. Adult male and female.

At all times more marine than the Goosander, the Red-breasted Merganser occurs regularly on the coast in winter and more rarely on inland waters. Locally it is a common visitor to the coastal areas of the Wirral Peninsula.

It breeds in Scotland, Wales and Ireland either inland or on the coast but never far from water. The nest is placed amongst boulders or under brambles and sometimes in a shallow burrow and consists of grass, dead leaves and down. The 7-12 or more eggs are stone-drab to greenish-buff in colour.

SHELD-DUCK - Tadorna tadorna (L.) Adult male and female.

This boldly plumaged duck is not uncommon on the coasts of the British Isles especially where there are mud-flats and low-lying sand-hills. It is one of the most characteristic ducks of the local coast and still breeds, but in gradually decreasing numbers, in the sand-dunes of Ainsdale and Freshfield. The nest is composed of bents and down and is usually placed down a rabbit burrow - hence its other name of "burrow duck". The 7-12 cream-coloured eggs are laid in May and after the young are reared the Sheld-duck leaves this country for several months to undergo a

moult.

COMMON SCOTER - Melanitta nigra (L.) Adult male.

Outside the breeding season this marine duck is frequently storm-driven to the coast, and occasionally to inland waters. Locally after bad weather it is sometimes abundant.

As will be noted from the specimen on exhibition the adult drake could hardly be confused with any other duck for apart from the yellow patch on its bill, it is entirely black. The female, on the other hand, is mostly dark-brown with whitish-brown cheeks. The Scoter breeds in a few places in Scotland and on at least one loch in Ireland. The nest is normally sited near lakes and consists of a hollow in the ground lined with grasses and down mixed with moss. In colour the 5-7 eggs are creamy-buff.

SCAUP - Aythya marila (L.)

This duck, although it has bred in Scotland and adjacent islands, is essentially a winter visitor to the bays and estuaries of the British Isles. It is a hardy and robust species being little affected by cold or stormy weather. Locally it is not uncommon occurring regularly off-shore in small parties and occasionally in flocks of 100 or more. Its regular breeding areas nearest to the British Isles include Iceland, ~~Faroes~~ and parts of Norway. The nest which is usually made on lake-islands, is a hollow in the ground lined with the nearest available material - down and feathers. The 6-7 or more eggs are similar to those of the Pochard.

Case E19. DUCKS

MALLARD - Anas platyrhynchos L. Adult male and female.

This species is the commonest surface-feeding duck in

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the British Isles. It breeds in most suitable localities and during the winter months our home-bred birds are joined by migrants from the continent. It feeds largely at night in fields, marshes and swamps leaving the security of inland waters or the sea at dusk, returning at dawn. The nest composed of down and feathers mixed with leaves is usually placed near water in a depression in the ground. From 7-13 dull green eggs are laid in May and sometimes earlier.

GADWALL - Anas strepera L. Adult male and female.

Not unlike the female Mallard but at once distinguished from it by its white speculum which forms a prominent patch on the hinder border of its wing, the Gadwall, although it breeds regularly in certain parts of England and Scotland is mainly a winter visitor to the British Isles. Its habits are similar to those of the Mallard but it is a shyer bird and at all times prefers quiet lakes, lochs and marsh-pools rather than the open sea. The nest which is usually placed in thick vegetation close to water is composed of down, grass and sedges and the 8-12 eggs are creamy-buff in colour.

POCHARD - Aythya ferina (L.) Adult male.

This handsome diving-duck breeds very locally but regularly in many parts of England and Scotland and is also a common winter visitor to most lakes, reservoirs and tidal estuaries of the British Isles. The distinctive features of the drake are its chestnut head, grey back and black breast and in flight the absence of any white in the wing is characteristic of both sexes. The nest is normally concealed in reeds or rushes and unlike that of most ducks is constructed in, or very close to, the water, dead flags and rushes being used to raise it above the water-level. The eggs, 6-11 or more, are greenish-grey, sometimes with a tinge of buff.

PINTAIL - Anas acuta L. Adult male

In winter this duck is a regular visitor to the estuary of the Dee and to similar coastal areas of the British Isles. The drake owing to its distinctive plumage, long neck and long pointed tail (hence its name 'Pintail') cannot well be confused with any other British duck. The female however is not unlike the female Mallard and the female Gadwall but its more delicate bill, and longer tail should prevent confusion. As a breeding species in the British Isles the Pintail, although it has bred in England and also in Ireland, is practically confined to Scotland. It breeds on lake-islands and also among marram grass on sand-dunes and on heather-covered shores of lakes. The 7-9 (and sometimes more) eggs are variable in colour and may be yellowish-green, yellowish-cream or bluish.

SHOVELER - Spatula clypeata (L.) Adult male.

Whether on land, on water or in the air the Shoveler can be distinguished from all other British ducks by its large spatulate bill, through the Lamellae of which particles of food, obtained by dabbling in shallow water or mud are sieved. Although the plumage of the drake is distinctive the duck, apart from her large bill, superficially resembles the Mallard duck but is smaller and like the drake Shoveler has a pale blue forewing which, in a good light, is quite noticeable.

Throughout the year the Shoveler frequents lakes, lochs, reedy meres and pools, and except when driven by hard weather conditions, rarely visits the sea.

The nest usually consists of a grass, down and feather-lined depression in the dry ground of a meadow or heath and the eggs, 8-12 in number, are greenish or buff in colour.

TEAL - Anas crecca L. Adult male and female.

The Teal, the smallest European duck (weight 12-14 ozs as compared with $2\frac{1}{2}$ - 3 lbs. in Mallard) breeds in many

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parts of the British Isles, and, as a winter visitor from the Continent to inland waters and to tidal estuaries, often occurs in considerable numbers. In habits it does not differ appreciably from other surface-feeding ducks. Like them it remains largely inactive throughout the day and obtains most of its food - a mixture of animal and vegetable matter at night.

The nest which is normally sited some distance from water consists of a sheltered hollow in the ground lined with leaves, dead bracken and down. About 8-10 stone coloured or light greenish-buff eggs are laid.

MAMMALS

General Characteristics

All Mammals are warm-blooded creatures which have hair and suckle their own young. They also possess a strong internal skeleton consisting of a skull, a backbone, ribs, a breastbone, fore-limbs and hind-limbs (there is only a vestige of hind-limbs present in whales). Mammals, however, possess a four-chambered heart and a membrane known as the diaphragm which completely divides their bodies internally into two parts.

Case Fl. BATS (Chiroptera)

Bats are at once distinguished from all other Mammals by their power of flight. A membrane stretches between each of the elongated fingers and bones of the hand. The thumb is free and is armed with a claw. The second finger is short and forms the front of the wing while the third finger is the longest. From the fifth finger the membrane continues along the flank and leg to the ankle. Another membrane, known as the interfemoral membrane, stretches between the legs and involves the tail. The legs are not as long as the arms, and the feet bear five small clawed toes.

The eyes are small and sight extremely poor. Bats, however, are constantly sending out impulses which are reflected back to them from solid objects. In this remarkable way they obtain their food of moths, beetles and flies.

In the spring a single young one is born blind and naked. It stays attached to its mother for about a fortnight; afterwards its mother during her flights leaves it hanging up by its feet but when she returns replaces it on her breast. When about three-quarters grown the young bat begins to fly.

All British bats are gregarious, and hibernate during the winter in caves, churches etc., where they hang by the feet

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asleep upside down with their wings folded round their bodies. In hibernation their temperature drops more or less to that of their surroundings and their breathing becomes shallow and slow.

In the British Isles only two families of bats are represented - the Earlet Bats (*Vespertilionidae*) and the Horseshoe Bats (*Rhinolophidae*). The Earlet Bats have a well developed "earlet" which corresponds with the small prominence in front of the human ear. In flight the tail is directed forwards forming a pouch which acts as a "nose-bag" when insects are eaten. The four species represented in this case belong to the *Vespertilionidae*.

The Horseshoe Bats have no "earlets". They have, however, a remarkable growth (nose-leaf) on the face which is shaped like a horseshoe. It is a sensitive organ for detecting the nearness of objects. Their tails are not so long as those of the Earlet Bats and are normally carried cocked up behind them. Their prey is, therefore, not pouched, but large insects are killed by pressing them with the mouth against the wing.

PIPISTRELLE BAT - Pipistrellus pipistrellus (Schreber)

This Bat is not only the smallest British species, but is also one of the most widely distributed, being found throughout the British Isles, inclusive of the Hebrides. It also appears earlier and retires later than any other British species often making its appearance as early as March and hibernating for the winter only when forced to do so by the onset of severe weather. Its flight is swift, accompanied by sudden turns and descents, and it may often be observed during the summer evenings flying about the city streets.

WHISKERED BAT - Myotis mystacinus (Kuhl)

Much less common than the Pipistrelle Bat the Whiskered

Bat occurs more frequently than elsewhere in the southern and midland counties of England. In Ireland it has been taken in several places but in Scotland it would appear to be unknown. In its mode of flight and general habits it is similar to the Pipistrelle. However it does not seem so averse to daylight as the majority of other bats.

NATTERER'S BAT - Myotis nattereri (Kuhl)

Extremely distinctive in flight owing to its white or whitish underparts this bat is found fairly generally in England and Wales, probably all over Ireland as well as the Isle of Man, but is almost absent from Scotland.

LONG-EARED BAT - Plecotus auritus (L.)

Readily distinguished by the enormous size of its ears which are proportionally longer than those of any other Mammal, this Bat is widely distributed throughout the British Isles. Although more nocturnal than most species it may sometimes be seen, especially in the vicinity of trees, hunting for insects in the early twilight. It is one of the few bats which is said to hunt throughout the night and to make use of the branches of trees as temporary resting places.

Case F2. WHALES (Cetacea)

Whales are not fish but mammals which are entirely adapted to an aquatic life.

The fore-limbs are modified into flattened paddles and there are no signs of hind limbs externally, although these are represented by a few small bones floating loose in the body. The tail forms horizontal "flukes", the up and down movement of which effects propulsion through the water. Hairs are almost entirely absent, but a few bristles are sometimes present in the region of the lips. A thick layer

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of "blubber" serves to keep the body warm and functionally replaces hair. Minute holes in the skin lead to the ears, and the nostrils, either single or double, are located on the top of the head and so come first to the surface of the water. "Blowing" is the release of air and water-vapour from the lungs, although if "blowing" commences before the surface is reached or should water be trapped in the side pockets of the nostrils during inhalation, water is also spouted.

The young whale resembles the adult and is suckled on the surface of the sea as the parent lies on her side. Whale milk has about five times the fat content of cow's milk and will not mix with sea water.

All whales are strictly carnivorous, live wholly in the water and should they become stranded on land are quite helpless and are suffocated by their own weight. Today whales are mainly hunted for their oil which is still used in the manufacture of soap and margarine.

Whales are divided into two main groups - the Whalebone Whales (Mystacoceti) and the Toothed Whales (Odontoceti).

1. Mystacoceti

The whales in this group are quite toothless and have wide lower jaws and mouths furnished with plates called whalebone. These plates which have their outer edges smooth and their inner ones fringed with extremely stiff hairs hang close together from the palate round the upper jaw. Water, containing small fish and shrimp-like creatures, flows freely into the mouth and between the plates and as it does so the fringes of the plates are pushed inwards by its force. When the mouth is closed the water flows outwards but solid objects are caught up by the fringes of the plates and are then swallowed.

LESSER RORQUAL - Balaenoptera acuto-rostrata Lacépède
 Scale model (1 inch to the foot) - from a 32 ft. specimen
 stranded at Ainsdale, Lancashire, 4th July, 1954.

This whale occurs in all the oceans of the world, but is not often observed in British waters. The sexes are alike and reach a maximum length of about 30 ft. In colour it is dark brown above and white below and can always be recognised by the presence of a large white patch on the upper surface of each flipper and also by its white or yellowish whalebone. Like the majority of whalebone whales it has many narrow grooves or pleats under its throat which enormously increase the capacity of the mouth.

2. Odontoceti

These whales have no whalebone but after birth develop permanent teeth. They have only a single blow-hole and as the wind pipe does not obstruct the gullet, as in whalebone whales, they can swallow comparatively large creatures such as Squids and Cuttle-fish etc. Toothed Whales, however, are chiefly remarkable for the asymmetry of their skulls - their jaws are always twisted to some degree either to the right or to the left.

COMMON PORPOISES - Phocaena phocaena (L.)
 Scale models (1 inch to the foot), from a specimen stranded at Hilbre Island, Cheshire, 27th February, 1954.

The Common Porpoise is the most abundant and best known of the British Cetaceans. It is sociable in its habits and herds may be seen around our coasts swimming with a series of undulating movements so characteristic of these mammals. Its food consists chiefly of mackerel, herring, and pilchards, although it also consumes salmon.

It rarely exceeds 5-6 feet in length. After ten months

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gestation a single calf is born which at birth is remarkable for its size often being more than half the length of its mother.

BOTTLE-NOSED DOLPHIN - Tursiops truncatus

Scale model (2 inches to the foot) from a specimen stranded at Hilbre Island, Cheshire, 16th September, 1953

Fairly common in the Irish Sea, the Channel and through the Dover Straits to the North Sea as far as Suffolk, this species is rarely stranded locally. It is mainly distinguished by its short beak, and by the fact that its flippers spring from the dark parts of its body.

Case G1

WILD CAT - Felis silvestris Schreber.

This fine untameable cat is confined to the rocky and mountainous areas of the Scottish Highlands where in spite of persecution it is not uncommon. Throughout most of the day it remains concealed in a fox's earth, under tree-trunks, or in a rocky cave from which it emerges in the early morning and late evening in search of Hares, Grouse and Blackcock which form its principal food. In May and possibly again in September 2-5 kittens are born. These are suckled for about 8 weeks and thereafter fed by both parents until they are able to fend for themselves.

BADGER - Meles meles (L.)

Although by no means common the Badger is still fairly numerous throughout the wooded areas of the British Isles, but owing to its nocturnal habits it is rarely observed. It is a tremendous digger and in rocky country will drive its galleries under and around boulders, constructing for itself a lair or "sett" from which it is almost impossible to eject it. In soft earth these "setts" often run under-ground for

more than a hundred yards. In the deep recesses of the "sett" a large nest is constructed of dry grass and ferns in which three or four young are produced, usually between March and June.

The food of the Badger consists chiefly of roots, fruits, nuts, truffles and frogs. Wasp grubs are particularly esteemed and when located are rapidly dug up with its strong claws. In general appearance the sexes are alike but the female ("sow") is usually slightly smaller than the male ("boar").

FOX - Vulpes vulpes (L.)

Mainly but not exclusively nocturnal the yelping bark of the dog and the answering eerie scream of the vixen may be heard at night during the mating season in early spring. At other times of the year the fox lives a solitary life hunting with proverbial cunning and often killing wantonly in excess of its needs, rodents, fowl, fish, young lambs etc., and in its turn being hunted for sport, a circumstance to which it probably owes its survival.

About March or April the vixen bears 3-8 young which are born blind in an "earth" which is usually a converted rabbit burrow or badger's sett, (the fox rarely digs its own earth). At about one month old the cubs emerge and are fed by the vixen on rats and mice. They are able to forage for themselves at 6 months and become adult in 12-18 months.

Case G2

OTTER - Lutra lutra (L.)

Wonderfully adapted to an aquatic life, the Otter which feeds almost exclusively on fish, has a long and sinuous body short muscular legs, webbed feet and a long horizontally flattened tail which serves as a powerful rudder. Although far from uncommon in many parts of the British Isles, such as

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the rocky parts of Somerset, Devon and Monmouthshire, as well as in the streams and lakes of Cumberland and Westmorland it is now rarely met with in districts like the fens of Norfolk, Suffolk and Cambridge where it was once so numerous. In England and the south of Scotland it is an inhabitant of fresh water - but further north as well as on the West coast of Ireland and in some parts of Cornwall it prefers the sea-coast, taking up its quarters in a cave.

Otters usually pair in mid-winter and from ten to five young are born during March or April, a well-concealed tunnel in a river bank or a hollow tree near the water serving as a den or "holt". Only one litter is produced in a year. The cubs are born blind, and usually remain with their parents until the autumn.

ALPINE HARE - Lepus timidus L.

This species is a native of the highlands of Scotland but has been artificially introduced into other parts of the British Isles. It is inferior in size to the Common Hare, the head is smaller, and the ears, tail and hind legs are relatively shorter. In many of the more northern parts of its range its coat becomes white in winter: the tips of its ears, however, remain black. The Alpine Hare does not prepare a "form" like the Common Hare, but conceals itself during the day in crevices, in rocks, and among boulders.

COMMON HARE - Lepus europaeus Pallas.

This well-known species is generally distributed throughout England and Wales, and the Lowlands of Scotland, but in Ireland it is unknown. It does not burrow like the Rabbit, but when threatened with danger either "freezes" or speeds away on its long hind legs. During much of the day it remains concealed amongst grass, ferns or bushes; its place of concealment being known as a "form".

Pairing is promiscuous and in mild seasons commences in February. March, however, is the real season of courting. The males then become excited and quarrelsome running to and fro, often kicking and biting each other as they do so. These displays occasionally end fatally. The two to four young have their eyes open when born, are clothed with fur and are almost immediately capable of running. The advanced condition of the young hares or "leverets" is connected with the fact that they are born in the open without the shelter of a burrow.

STOAT - Mustela erminea L.

Less nocturnal than any other British flesh-eating mammal the Stoat is common in most parts of the British Isles but is absent from the Islands of Arran, Harris, N. and S. Uist and the Orkneys. In Ireland and the Isle of Man it is replaced by an allied form and there is also a form (recinae) peculiar to Islay and Jura. The Stoat frequents woods, moorland and rough ground near cultivation and nests in hollow trees, walls, banks and thickets. Usually there are 5-8 young at birth. Its prey consists principally of Voles, Mice, Rats, Rabbits and Hares which are relentlessly hunted both by sight and smell. The winter change of its coat from brown to pure white (except the tail tip which always remains black) is rare in this country and depends on local temperatures. In the South of England for instance the change is rarely complete.

RED SQUIRREL - Sciurus vulgaris L.

The Red Squirrel occurs throughout suitable wooded areas in the British Isles. It is plentiful in Cheshire, common in North Wales, but rarer in the Lake District. In Ireland where it was artificially introduced it is now fairly abundant. Although nuts form its principal diet, fungi of various kinds, eggs and young birds are also eaten. Squirrels

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are also fond of the inner bark of trees, especially during Spring when the sap flows freely, and at that season they do much harm to plantations.

In autumn nuts are collected and stored in holes in the ground and in trees for winter use. This food reserve is drawn upon at intervals, since squirrels do not hibernate throughout the winter, but become torpid for long or short periods during cold wet weather.

Both the male and the female build nests, or "dreys" in which to live. They are globular in form, with an entrance generally at the side, and are constructed of leaves, twigs, and moss. These shelters are often in conspicuous situations in the forks of trees, but the nursery of the female, which is made in much the same manner, is carefully concealed among the branches of a thick conifer tree or in a hollow tree trunk. The two to four young are born in May or June. Squirrels differ considerably in general appearance at different seasons of the year, due in part to the bleaching effect of light on the fur, and in part to the shedding of the coat.

GREY SQUIRREL - Sciurus carolinensis Gm.

This Squirrel is a native of America and was introduced into the British Isles at various dates from 1876-1910. Since the original introduction it has rapidly increased and wherever it occurs it is now looked upon as a serious pest. It is destructive to all kinds of trees and fruits and in many places has driven out the native Red Squirrel. Its domed nest with hidden side entrances is composed of leaf-bearing twigs and is normally constructed in deciduous trees and occasionally in conifers. Three to five young are born in March and April and again in June and July. At birth they are both blind and hairless.

HEDGEHOG - Erinaceus europaeus L.

The Hedgehog except in the extreme north-west and the Scottish Isles is a common creature in most parts of the British Isles. Its most characteristic feature is of course its dense protective coat of short spines but even when rolled up into a prickly ball the Hedgehog is often successfully attacked by foxes, badgers and dogs.

Its food consists principally of beetles and other insects, slugs, worms and frogs all of which are hunted at night.

Early in summer a bulky roofed nest is constructed of dead leaves and moss in a dry bank. In this nest from four to seven young are produced in May or July and sometimes again in August or September. At first the young are quite blind and covered with soft spines which take about a week to harden. Late in November or early in December the Hedgehog hibernates - until April.

SKELETONS

General Characteristics

A skeleton gives mechanical support and protection to the body and provides a surface for the attachment of the muscles. It may be an external skeleton (exoskeleton) as in some Invertebrates, e.g. the shell of the snail, the hard outer covering of the crab, or an internal skeleton (endoskeleton) as in the Vertebrates. An exoskeleton severely limits the size of the animal, whereas an internal skeleton allows for a larger body to be built up over the supporting framework of bones. Thus Vertebrates are much larger than Invertebrates and some have attained a very great size indeed e.g. rhinoceros, elephant, etc. Whales can grow even larger as their weight is partly supported by water.

The skeleton of a Vertebrate can be divided into two parts:- 1) the axial skeleton consisting of the skull and the vertebral column (backbone) which is formed from a number of connected vertebrae some or all of which may have ribs attached; and 2) the appendicular skeleton consisting of the shoulder (pectoral) girdle and a pair of fore-limbs, and the hip (pelvic) girdle with a pair of hind-limbs. These main structures can be distinguished in all the skeletons shown in Case Fl. - dogfish, frog, pigeon, dog.

Throughout all the land-living Vertebrates (amphibians, reptiles, birds and mammals) the paired limbs show a similar structure. The fore-limbs always consist of an upper arm (humerus), a fore-arm (radius and ulna), a wrist (carpals), palm (metacarpals) and typically five fingers (phalanges), whilst the hind limbs consist of an upper leg (femur), lower leg (tibia and fibula), ankle bones (tarsals), sole (metatarsals) and typically five toes (phalanges).

Case H1. SKELETONS

DOGFISH

Fishes can be divided into two groups -- those with cartilaginous (gristly) skeletons such as sharks, skates and rays and those with bony skeletons: e.g. perch, breams, plaice, herring, etc. The dogfish belongs to the former group. Its backbone or vertebral column is divided into two regions -- the trunk and tail. The shoulder or pectoral girdle is U-shaped and supports a pair of pectoral fins which correspond with the fore-limbs of the higher vertebrates. The hip or pelvic girdle is flatter and supports a pair of pelvic fins which correspond with the hind limbs of the higher vertebrates. All the fins, both paired and unpaired have a framework of cartilaginous fin rays.

FROG

The backbone of the frog is extremely short consisting of only 9 vertebrae, the last one articulating with a slender rod -- the urostyle. The deep V-shaped pelvic girdle is stout and rigid and supports the long hind limbs which are strongly developed for jumping. The fore-limbs are much shorter and both fore- and hind-limbs show the typical structures found in the limbs of land vertebrates. (See under General Characteristics).

PIGEON

The skeleton of the pigeon is very delicate for, as is the case with the majority of birds, many of the bones contain air cavities which give the whole structure lightness in flight. The jaws project forwards to form a beak and there are no teeth. The neck is long and flexible consisting of about 16 vertebrae, whilst in the hip region the vertebrae are fixed to form a rigid structure (known as the synsacrum)

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which supports the hip-girdle and hind limbs and so takes the weight of the whole body. The ribs are joined below by the sternum or breastbone which is enlarged and has a keel to which are attached the large muscles used in flight. The "wish bone" or clavicle forms part of the shoulder girdle. The bones of the "hand" are greatly reduced in number and are modified to form a support for the flight feathers. The ankle bones are fused for greater strength, and in the Pigeon there are 4 toes - 3 in front and one behind.

DOG

This shows the typical features of a mammalian skeleton. The teeth are set in sockets and are of a definite number, the canines or eye teeth being greatly enlarged (as in all carnivores) as they are used for tearing flesh. Note the fact that the dog stands permanently raised up on its toes, and that the ribs are joined below by a flexible cartilage to form a protective basket for the lungs and heart.

Case H2. SKULLS

OX

The skull of the Ox is remarkable for its great thickness of bone. The frontal bones are drawn out into horn cores, and the orbit is prominent, circular and complete. The teeth always important in the study of Mammals, are used for grinding the grass on which the animal feeds and for this reason have broad crowns with crescentic ridges. There are no upper incisors and the upper canines are also absent, whilst the lower canines are shaped like incisors. A large gap (diastema) separates the canines from the large molar teeth.

BOTTLE-NOSED DOLPHIN

The skull of this whale like the skulls of all toothed

whales is remarkable for its asymmetry. The face is drawn out into a long beak armed with 80-88 single-rooted uniform teeth.

COD

Unlike that of the Dogfish the skull of the Cod is fully ossified. The number of plate-like bones of which it is composed make it an extremely complicated structure.

Cases H4. & 5. SKELETONS OF MAN AND GORILLA

Although its skeleton is more massive in structure than that of Man, the Gorilla does not stand as high, as its normal posture is a semi-erect one, the body being balanced on the knuckles of the disproportionately long arms. In adult Man posture is upright and the fore-limbs take no part in progression, the hind-limbs being sufficiently capable of supporting and moving the body unaided. In the Gorilla the big toe as well as the thumb is opposable i.e. both hands and feet are capable of grasping actions, but in Man the big toe is fixed parallel to the other toes and has not this ability.

The vertebrae, limbs and girdles of the Gorilla reflect its near relationship to the Chimpanzee but owing to its great weight many of its bones are considerably widened. The spines of several cervical vertebrae are also enlarged for the great muscles of the neck, and to accommodate the wide abdomen and the gluteal muscles the ilia are considerably expanded transversely.

The skull of Man differs from that of the Gorilla in having a much greater cranial capacity; the jaws lie more directly beneath the cranium whereas in the Gorilla the forehead recedes and jaw is protruded in front of the cranium. The canine teeth are much less well developed in Man and are scarcely distinguishable superficially from the incisors. In

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the adult Gorilla there are very prominent bony ridges above the eyes and there is a sagittal crest on the back of the skull, both features not found in Man. In the male Gorilla the os penis is vestigial but in Man it is quite absent. Thus the Gorilla has almost lost one of its supposed distinctions from Man.

!! SPECIMENS REQUIRED !!

THE MUSEUM LOST THE LARGER PART OF ITS EXHIBITED COLLECTIONS DURING THE WAR AND IS DOING EVERYTHING POSSIBLE TO REPLACE THIS MATERIAL. THE CO-OPERATION, THEREFORE, OF ANYONE WHO IS GOING ABROAD AND IS WILLING TO COLLECT FISHES, SNAKES, BIRDS, MAMMALS, ETC. ON BEHALF OF THE MUSEUM WOULD BE GREATLY VALUED. ANYONE INTERESTED IS INVITED TO APPLY TO THE KEEPER OF THE DEPARTMENT FOR THE NECESSARY INSTRUCTIONS ON COLLECTING, PRESERVING, PACKING AND SHIPPING.

Books recommended for further reading:-

J. Travis Jenkins The Fishes of the British Isles. Warne & Co. 1936.

Francis Day The Fishes of Great Britain and Ireland, Vols I & II. Williams and Norgate. 1880-84.

Malcolm Smith British Amphibians and Reptiles. New Naturalist Series. Collins.

H.F. Witherby et. al. The Handbook of British Birds, Vols I-V Witherby. 1938.

Gerald E.H. Barrett-Hamilton et. al. A History of British Mammals, published in parts. Gurney & Jackson. 1909 onwards.

Edward Step Animal Life in the British Isles. Warne & Co. 1946.

Edmund Sandars A Beast Book for the Pocket. Oxford University Press. 1937.

R. Wagstaffe & J.H. Fidler Preservation of Natural History Specimens, Vol. II. Vertebrates (in preparation). Witherby & Co.